A HUMAN BURIAL FROM DOLORES COUNTY, COLORADO

Diane L. France

Bureau of Land Management
Colorado
Cultural Resource Series • 24

A HUMAN BURIAL FROM DOLORES COUNTY, COLORADO

By

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Colorado State Office

Bureau of Land Management

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FOREWORD

Volume 24 of the Bureau of Land Management's (BLM) continuing series of cultural resource monographs presents an analysis of human remains conducted by Dr. Diane France, Colorado State University, Fort Collins, Colorado.

The skeletal remains were discovered during the test excavation of a small pueblo ruin which was threatened by disturbance during construction of an oil well. The remains were found in Dolores County on land administered by BLM. Results show the skeleton to be those of an American Indian Pueblo male about 35 years of age. The individual probably met his final fate about 770 years ago via one or more severe blows to the head; he was also scalped. Dr. France was contracted by BLM to do a study to preserve as much information as possible considering the remains probable reburial.

The Department of the Interior has guidance pertaining to the treatment and disposition of human remains removed from land under its jurisdiction. Our policy calls for making all decisions relative to exhumed human remains on a case-by-case basis. The land manager responsible for the decision must weigh the scientific value of the remains against the religious or other sentiments of a group or groups claiming affinity with a specific collection of remains and make a decision consonant with his/her statutory responsibility.

The introduction in this report reflects Dr. France's concerns as a physical anthropologist about the preservation for scientific study of not only those remains, but of human skeletal material in general. The opinions contained in the introduction are those of Dr. France and do not necessarily reflect BLM policy.

It is with pleasure that I offer this report in BLM's continuing quest to present knowledge gathered by the study of BLM-administered lands in Colorado.

Associate Tom Walker

Neil F. Morck
State Director, Colorado

PREFACE

The treatment and ultimate disposition of the exhumed remains of a male Indian excavated by Powers Elevation from a small pueblo site in Dolores County, Colorado (5DL975) has received significant attention since its discovery and removal in 1984. Powers Elevation, adhering to state of Colorado policy, was advised to deliver the remains to the Office of the State Archaeologist. The State Archaeologist then turned them over to the Colorado Commission of Indian Affairs (CCIA) for storage at the University of Colorado until they could be reburied.

State of Colorado policy does not apply to human remains removed from public lands administered by the federal government. The Bureau of Land Management (BLM) has the discretion of treating human remains on an individual basis. In the case of the skeleton from 5DL975, BLM chose to negotiate with the Colorado Native American Heritage Council (CNAHC) and the CCIA for the return and study of the skeleton before reburial. The decision was made to conduct a preliminary analysis to determine if the remains did retain significant scientific value. Dr. Diane France of Colorado State University at Fort Collins, Colorado, was contracted by BLM to do the osteological analysis. Once the study was completed, the material was delivered to BLM's Anasazi Heritage Center near Dolores, Colorado. On November 5, 1987, with respect for the wishes of the Native Americans, the skeletal remains were reburied in a quiet ceremony on public land.

This report, prepared by Dr. France, represents one of the most extensive studies of its kind to date. It is apparent that this document will become a standard reference in the laboratory study of osteological remains; therefore, we have reproduced the photographs on quality paper.

Richard E. Fike
Montrose District Archaeologist

OSTEOLOGICAL REPORT
FOR 5DL975

prepared for
The Bureau of Land Management

by

Diane L. France, Ph.D.
Colorado State University
Department of Anthropology
January 30, 1987

Please Note: This "report" consists not only of the written material, photographs and sharp-shadow tracings contained here, but also consists of two plaster/plastic skeletal (intact bones except ribs, vertebrae and phalanges) casts, complete x-rays, a femoral midshaft cross-section stained with Frost´s (1958) basic fuchsin stain, and a facial reconstruction. Also, very many photographs were taken which are not shown here, but the negatives of which are on file. These items will be loaned to any researcher upon request.

INTRODUCTION

An essentially complete skeleton was discovered during testing excavations of site 5DL975 in Dolores County, Colorado in May and June of 1984 (see Cultural Resource Management Report by Powers Elevation in Appendix A). The skeleton was immediately delivered to the Colorado State Archaeologist who in turn delivered it to the Colorado Native American Heritage Council (CNAHC) for inclusion in their reburial program. After lengthy negotiations between the CNAHC and the Bureau of Land Management (as site 5DL975 is situated on lands overseen by the BLM), the skeleton was offered for scientific study before the proposed reburial.

Ms. Mary Lucas Powell of the Smithsonian Institution was retained to assess the potential value of the skeleton for scientific research (please see her report in Appendix B). Because of the excellent preservation of the skeleton, Ms. Powell recommended further scientific analysis.

This report is intended to preserve much of the scientific information which would otherwise be lost with the reburial of any skeletal material. The report is not intended to be a complete analysis of the skeleton, as such an analysis is beyond the scope of a single researcher within a short period of time, but instead will provide future researchers with the raw information they will need to include this skeleton in their own studies. Such is the basic purpose in permanent curation of skeletal materials in museum or university collections. It is important at this point to stress that all of the discussions below apply to the curation of <u>all</u> skeletal material, not only the curation of American Indian prehistoric remains.

At least one difference remains, however, between the retrieval of the type of information contained within this report and the permanent curation of a skeleton. While this report contains vast amounts of information about the 5DL975 skeleton,

researchers today will never be able to anticipate the research demands and directions of the future. A few years ago a report of this type would not have included trace element analysis of bone using energy dispersive X-ray flourescence spectrometry. Likewise, the use of tandem accelerator mass spectrometry for quite precise carbon-14 dating of the remains, and the use of a scanning electron microscope for analysis of cut marks on bone have been employed only relatively recently. A few decades ago even simple x-rays would not have been included. Holograms, a three-dimensional picture, are not practically available today, but perhaps the technology will be more readily available in just a few years. We can never know what kinds of information more advanced technology will allow in the future, and the only way we can assure the recovery of that information in the future is in permanent curation of the skeleton. It is important at this point to stress that all of the above discussions, and most of the arguments below, apply to the curation of <u>all</u> skeletal material, not only the curation of American Indian prehistoric remains.

Why, then, is the information gathered from a skeleton important to even today´s scientists? What can we possibly learn from an individual who lived so long ago? It is unjustifiable to say that only the physical anthropologist, archaeologist, physician or lawyer benefit from the study of human skeletal remains, for the general public benefits as well, as can be seen in the following arguments.

It seems obvious to assume that a skeleton will display the characteristics determined at least to some extent by the genetics of the individual at conception. Sex, race, adult stature, for instance, can be determined from even sometimes small fragments of a skeleton. But the skeleton is also a living, dynamic tissue which responds to nutritional changes, disease, trauma, muscle use and even to many cultural practices. Also, because this tissue contains many inorganic elements, the skeleton and teeth usually remain long after the rest of the body has decayed and are therefore able, sometimes hundreds or thousands (or millions, in the case of mineralized fossils) of years after death, to tell scientists much about the individual and the society and environment in which he lived.

Many diseases and nutritional deficiencies: severe anemias of various forms, cancers, tuberculosis, infections, arthritis, and many others, leave both macroscopic and microscopic marks on bone. By studying these aspects of the skeleton, we can know not only the medical history of a particular person, but also the potentially the history of a group of people, diseases, and medical conditions. For example, periodic nutritional stress (e.g. moderate famine every late winter when stored food is running short), or even the presence of a moderate fever can leave "Growth Arrest Lines" in the bones of a child. Although these lines are eventually erased in adulthood by the constant

remodelling of bone, they can be detected by x-ray or by visual inspection of a longitudinal cross-section of a bone before remodelling takes place.

Many kinds of trauma, such as fractures, cutting and stabbing marks and bullet wounds, are obviously reflected in the bone, but even the traumas of childbirth are often recorded. As can be seen in this report, intentional scalping can be identified in an individual as well. Often the instrument of trauma, the type of sharp edge, even the direction of travel of a projectile (bullet, arrow point, etc.) can be determined from its effects on bone. One can determine whether the insult to the body occurred at about the time of death, thereby potentially being the manner of death; long after death in essentially dry bone; or long before death in which some degree of healing has taken place. When some healing has occurred, a rough estimate of the time since the trauma (given nutritional status, age, etc.) may be given.

Different kinds of habitual muscle use or posturings of the body are often reflected in the skeleton. Squatting facets, which are named for that habitual posture are often found in the articular surfaces of foot and leg bones, while many different kinds of cranial shapes are related to either intentional deformation of different parts of the skull, or are the result of strapping the infant to a cradleboard. We know that certain societies habitually practiced these customs, so a skeleton exhibiting these deformations will add evidence of the presence of certain cultural groups in a geographic area. Habitual hunter-gatherers versus habitual agricultural groups often use their muscles in different ways, just as a modern-day body builder will usually use different muscle groups (and with more intensity) than a sedate business executive. A right-handed person will often show more developed and more rugged muscle markings in his right arm, and will also show differences in his right scapula (shoulder blade) from that of a left-handed person. From studies of these differences, we might learn not only about the occupational effects on bone for human identification purposes, but also the effects of weight-lifting and jogging, horseback riding and hoeing, for example, on bone.

Aside from the considerations of personal identification from the skeletal remains (or even those not completely skeletonized) for the police or coroner, and aside from the physician´s interest in disease processes or the anatomist´s interest in biomechanical differences with different muscle use, there are many other aspects of the skeleton useful to other professions and to the public. With the identification of a very old burial ground readily identifiable with a specific Indian group, for instance, disputes as to traditional ownership of land could be resolved. The medical profession has rediscovered the benefits of many naturally-occurring drugs traditionally used by American Indian groups.

A word of caution is appropriate at this point. It has sometimes been assumed that because a skeleton is buried in an area traditionally used for American Indian burials it is probably an American Indian, and should be left alone or immediately reburied. Someday, if it hasn´t already occurred, a modern homicide victim (American Indian or not) will be left alone or immediately reburied, much to the joy of the killer. A physical anthropologist, or someone knowledgeable about skeletal identification should be called in all questionable situations. Most physical anthropologists also have stories of nonhuman bones having been treated as homicide victims or as ancient burials, and this should obviate the need for expert advice.

With all of the information we now have about the skeleton, however, many areas have not yet been adequately studied. We cannot yet determine, for instance, the sex from the skeleton of a person under the age of puberty. Physical anthropologists are able to determine in many cases whether or not a woman has given birth, but we are not able yet to determine how many children she has had. We know that different American Indian groups differ in their facial morphology, but we haven´t yet standardized those differences so that we can reliably identify all ethnic groups from the skeleton. Relatively few specialists are able to reliably identify the regional differences in any racial group. Our age estimates from the skeleton are today very good, but we need to become even more precise, especially for those mass disasters where, for instance, several men within a few years of same age might be among the unidentified. The stature equations, which are based on long bone length, are different for different race and sex groups and need to be studied in more depth to create more precise estimates for more groups. All of these studies must be conducted on the skeletons themselves, and it is readily seen that the scientist needs skeletal materials from <u>all</u> racial and ethnic groups. Even if we knew all there was to know about a skeleton, we would not be able to adequately teach our students the standard techniques without the materials to show in class.

Having presented the above justifications for permanent curation of the skeleton, physical anthropologists and museum specialists can also make some concessions to concerned American Indian groups in some issues. Most important is the issue of display of American Indian (or other racial group) remains in museums and universities. Where scientific study is not the primary interest, photographs and complete skeletal casts should be used in place of the skeleton itself.

In addition, physical anthropologists, archeologists, physicians, and all other researchers of science must make the results of their research more readily available to the general public. We must not only demonstrate the complete respect shown to remains of all races, but also to show the lack of desecration of the skeleton. Just as important, however, is that by sharing the information we obtain from the skeleton with other groups,

everyone can benefit from the vast knowledge of customs, traditional medical expertise, etc. in members of American Indian groups, and individuals of other ethnic groups. Members of the scientific community have traditionally been viewed as unwilling to share information with anyone but other members of the profession, and it should not be too surprising that we are also sometimes viewed with the distrust which comes from that lack of complete disclosure. With that, however, must be an effort by the general public to understand the importance of scientific research, and to seek out professionals for information. True scientists are always willing to talk about their research to anyone who is interested.

In that vein, this compilation of information is offered to any individual: research scientists or interested layperson. It is intended to contain enough information to be useful for research, but to include enough general information that a person unfamiliar with technical jargon will be able , with the help of an anatomy book or Bass (1971), to obtain useful data as well.

ACKNOWLEDGEMENTS

Many individuals aided in the completion of this report by suggesting the kinds of information to be included. I asked many individuals just in passing to provide suggestions, so I cannot be sure I have included all names here. I ask forgiveness from anyone who is not, but should be, mentioned. Participants of the Mountain, Desert and Coastal Forensic Anthropologists were especially helpful, and included Drs. Sheilagh and Richard Brooks, Alice Brues, Walter Birkby, George Gill, Stan Rhine, Judy Suchey, Roger Heglar, Michael Hoffman, and many others.

Participants in the Paleopathology meetings in Albuquerque were also helpful in helping to establish the authenticity of the scalp marks.

Dr. William Bass provided much information about the kinds of measurements often included in the collections at the University of Tennessee at Knoxville.

While I am absolutely grateful to the many individuals listed above, I am, of course, completely responsible for the information and mistakes contained within this report.

Please Note:

Additional scientific materials produced through analysis of this skeleton include two intact plaster/plastic skeletal casts, minus ribs, vertebrae and phalanges, complete x-rays, and a facial reconstruction, all of which are stored at the BLM's Anasazi Heritage Center near Dolores, Colorado. A collection of photographs and negatives, not used in this report, also exist. All of these materials are available for use by research scientists.

OVERVIEW OF SKELETON 5DL975

ABSTRACT:

The skeleton represents an American Indian Pueblo male, 35 ± about 5 years of age, 5 ft. 7 inches tall ± 1.5 inches. This individual lived approximately 770 years ago, and had been scalped at about the time of death (see photos 3-15 through 3-31). In addition to the scalping marks, the cranium exhibited two depressed fractures with radiating fracture lines, which may also have occurred around or after the time of death (see photos 3-6 through 3-130. No other trauma is evident on the skeleton, but increased porosity of the cranium is seen in the region of Bregma (photo 3-14), and a small lesion is apparent on the 3rd cuneiform (tarsal) of the left foot (photo 3-127). This individual also exhibits congenital bilateral absence of the mandibular canines.

Information to support the above statements is given below:

SEX: The sub-pubic angle and greater sciatic notch are both narrow, and the areas for muscle attachment are large and well-developed, including . those on the cranium. In addition, the supra-orbital torus is pronounced, the chin is square, the palate deep, and the supra-orbital rim is rounded. All of the above features are indicative of a male skeleton.

AGE: The pubic symphysis shows development characterized by late Suchey-Brooks Phase III standards for males. The mean age for this phase is 28.8 years with a 95% range of 22 to 43 years. This is one of the most reliable methods of age determination. The development of sternal ends of the ribs and the degree of tooth wear are consistent with this age determination.

Microscopic examination of the cross-section of the left femur is fairly consistent with this age determination. The number of whole and partial osteons, lamellar bone and non-Haversian canals renders an age slightly higher than that stated above, but the lack of resorption of cortical bone in this sample suggests that this individual is just under or about 40 years of age (Kerley 1970, Ubelaker 1978) (see photographs 3-169 through 3-173).

RACE: This skull exhibits shoveled incisors, "tented" nasal bones in which the maxillary bones at the nasal region are more perpendicular to the line of view (that is, they "look at you"), and there is a break in contour between the nasal bones and the maxillary bones of the region. In addition, the nasal aperture is wider than that expected in a Caucasoid, and the inferior rim is somewhat rounded (but not "guttered" to the degree seen in a "typical" Negroid cranium). The eye orbits are rounded, the zygomatic bones are projecting forward (producing a more

prominent cheek), and the dental arcade is parabolic to "horseshoe" in shape. All of the above are highly characteristic of an American Indian, but in addition, this cranium exhibits lambdoidal deformation (flattening), which is typical of the Pueblo groups, who carried their infants in cradleboards. No characteristics of this skeleton contradict the above racial diagnosis.

STATURE: The Trotter and Gleser (1958) regression formula utilizing femur and fibula for Mongoloid males resulted in the above stature.

TIME SINCE DEATH: A portion of the left humerus was sent to the University of Arizona Tandem Accelerator Mass Spectrometer (TAMS) Laboratory for Carbon-14 dating. The age was determined to be 770 $\pm$ 60 years BP (before 1950). They found that there is a 68% probability that the true years from which the sample came were in the range AD 1180-1290, and a 95% probability that it came from the range AD 1160-1300.

Note: many other characteristics of a skeleton not listed here aid in determination of age, sex, race, stature, etc. The more important items are noted, and because this is an unambiguous case, the need to list the other characteristics is decreased.

SKELETAL INVENTORY

C = Complete B = Broken but essen. complete
F = Fragmentary A = Absent

CRANIUM

	L	R
Parietal	C	C
Temporal	C	C
Maxilla	C	C
Nasal	C	C
Zygomatic	C	C
Lacrimal	C	C
Palatine	C	C
Malleus	?	C
Incus	?	?
Stapes	?	?

Frontal	C
Occipital	B
Sphenoid	C
Ethmoid	C
Vomer	C

MANDIBLE C

(? = may yet be inside auditory canal)

VERTEBRAE

C1	C
C2	C
C3	C
C4	C
C5	C
C6	A
C7	C
T1	C
T2	C
T3	C
T4	C
T5	C
T6	C
T7	C
T8	C
T9	B
T10	B
T11	C
T12	C
L1	C
L2	B
L3	C
L4	C
L5	C
COX1	C
COX2	A
COX3	A
COX4	A

RIBS

	L	R
1	C	A
2	B	B
3	B	B
4	B	C
5	B	B
6	B	B
7	B	B
8	C	B
9	C	B
10	C	B
11	F	F
12	F	F

SACRUM C

STERNUM

Manubrium	C
Body	A
Xiphoid Process	A

OTHER PAIRED POSTCRANIAL BONES	L	R		L	R
Scapula	C	C	Innominate	B	B
Clavicle	C	C	Femur	C	C
Humerus	B	C	Patella	C	A
Radius	C	B	Tibia	C	C
Ulna	C	C	Fibula	B	C

HANDS

CARPALS	L	R
Navicular	C	C
Lunate	C	A
Triquetral	C	A
Pisiform	A	A
G. Multangular	A	A
L. Multangular	A	A
Capitate	C	C
Hamate	A	A

METACARPALS	L	R
First	A	C
Second	C	A
Third	A	A
Fourth	C	C
Fifth	A	A

PHALANGES	L	R		L	R		L	R
Proximal			Middle			Distal		
First	C	A				First	C	A
Second	C	C	Second	C	C	Second	A	A
Third	C	C	Third	F	C	Third	A	A
Fourth	A	A	Fourth	A	A	Fourth	A	A
Fifth	C	A	Fifth	A	A			

FEET

TARSALS	L	R
Calcaneus	C	A
Talus	C	A
Navicular	C	A
1st Cuneiform	C	A
2nd Cuneiform	C	A
3rd Cuneiform	C	A
Cuboid	C	A

METATARSALS	L	R
First	C	A
Second	C	A
Third	C	A
Fourth	C	A
Fifth	A	A

PHALANGES	L	R		L	R		L	R
Proximal			Middle			Distal		
First	C	C				First	C	A
Second	C	C	Second	A	C	Second	A	A
Third	C	C	Third	A	A	Third	A	A
Fourth	C	C	Fourth	A	A	Fourth	A	A
Fifth	A	C	Fifth	A	A			

Figure 3-1: Cranium and Mandible

Figure 3-2: Cranium and Mandible, Right Side

Figure 3-3: Stereopairs, Cranium and Mandible
(use stereopairs glasses)

Figure 3-4: Stereopairs, Cranium and Mandible
(use stereopairs glasses)

Figure 3-5: Stereopairs, Cranium and Mandible
(use stereopairs glasses)

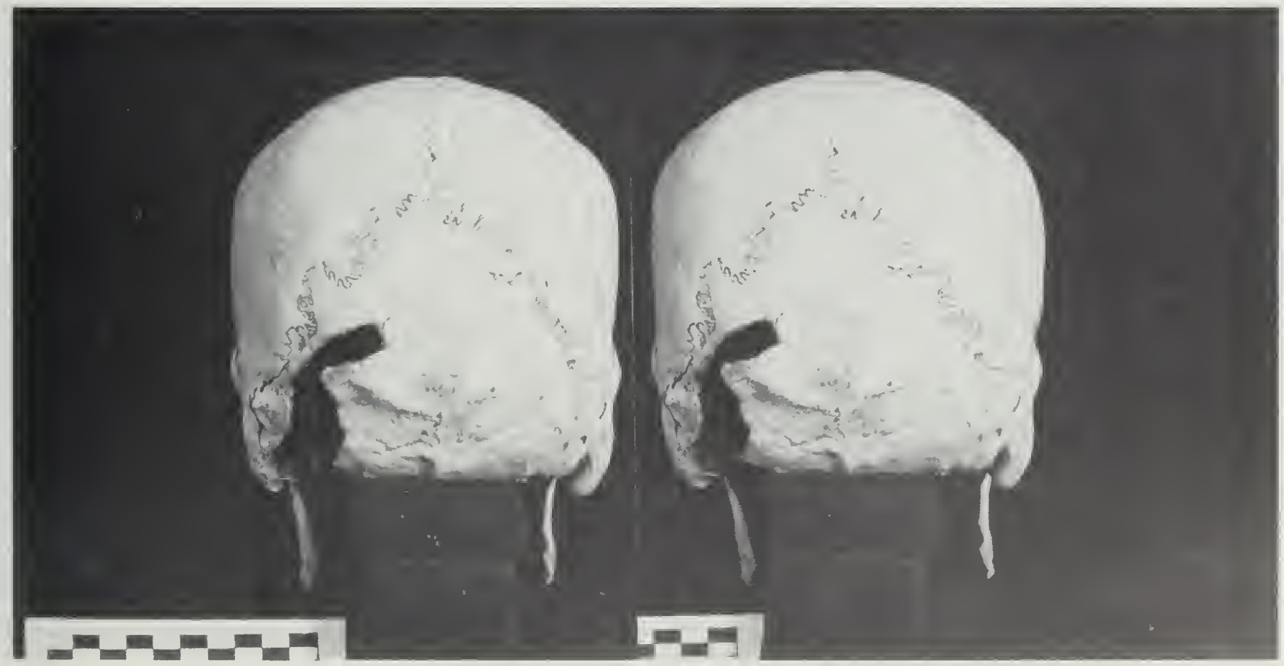


Figure 3-6: Stereopairs, Occipital View, Cranium
(use stereopairs glasses)

Figure 3-7: Cranium and Mandible, Left Side

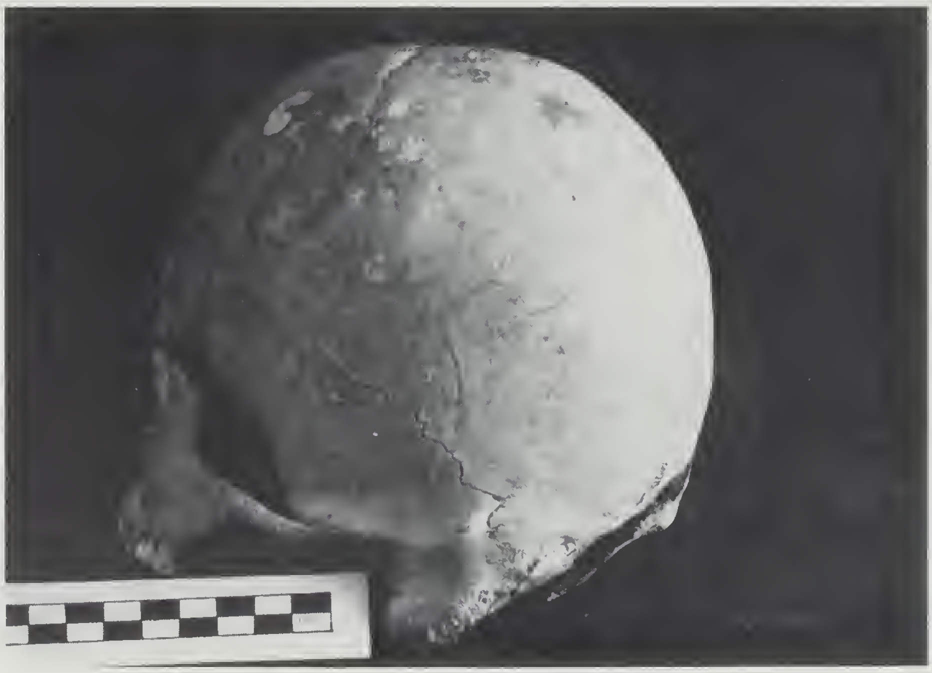


Figure 3-8: Left Parietal
note circular depressed fracture with radiating fracture lines

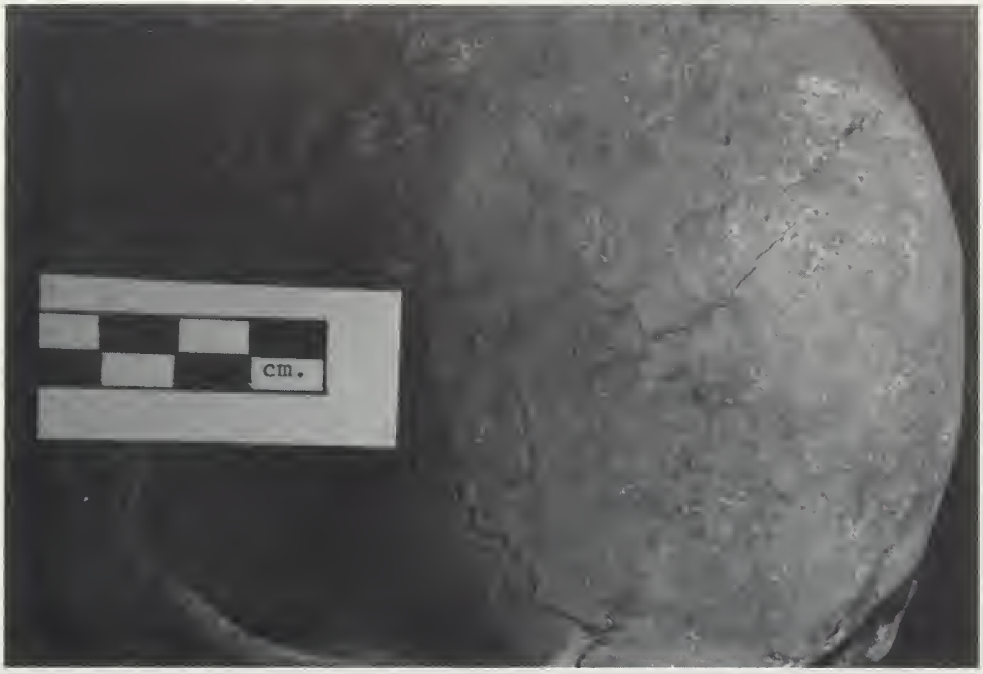


Figure 3-9: Left Parietal
closeup of circular fracture

Figure 3-10: Cranium, Occipital Bone
Fracture in left occipital has beveled edges
and radiating fracture lines

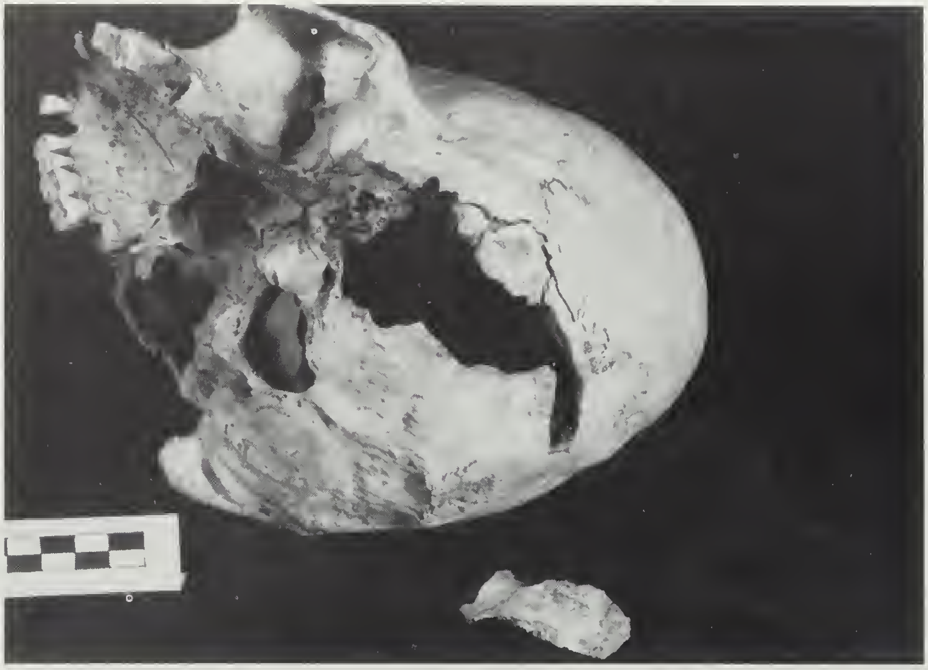


Figure 3-11: Fracture in Left Occipital Region
cranial fragment found as separate fragment

Figure 3-12: Closeup of Fracture in Left Occipital Region

Figure 3-13: Cranium, Caudal View

Figure 3-14: Bregma, Frontal Bone at Left
note increased porosity in this region

Figure 3-15: Frontal Bone Scalping Marks

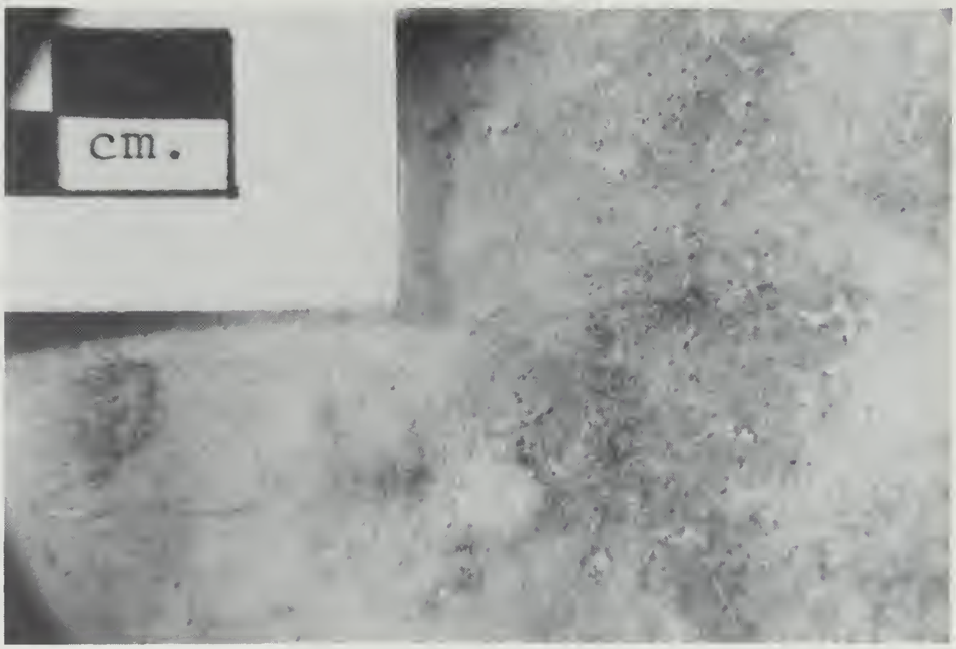


Figure 3-16: Closeup of Scalp Marks

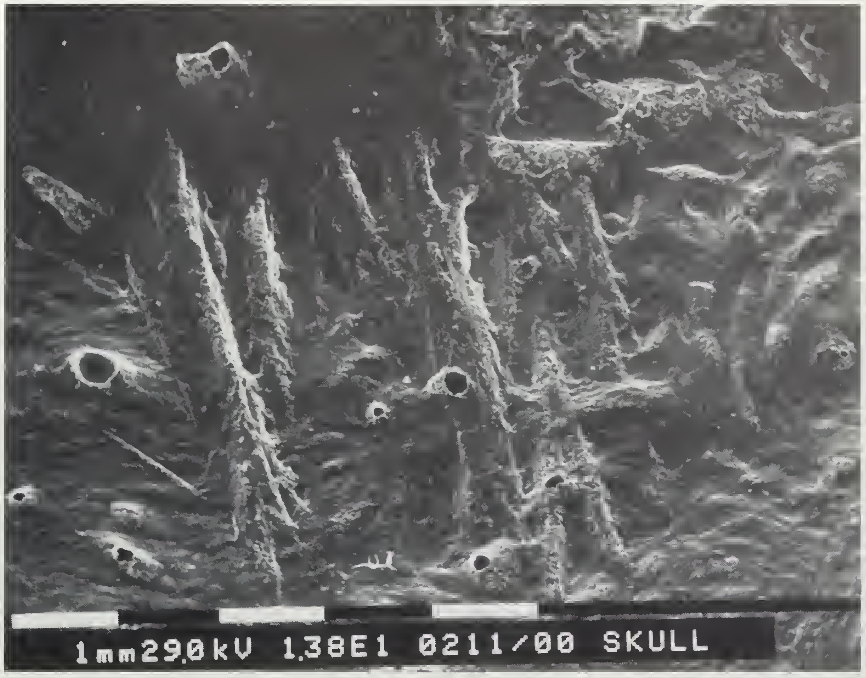


Figure 3-17: Scanning Electromicrograph
Cut Marks on Mastoid Process
Magnification: X 13.8

Figure 3-18: Scanning Electromicrograph
Cut Marks on Frontal Bone
Magnification: X 40.8

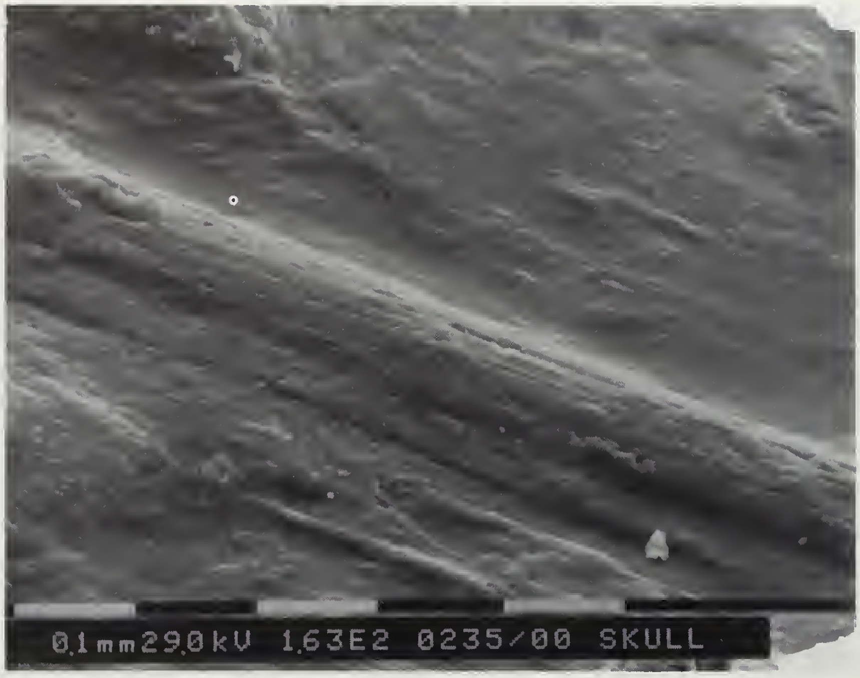


Figure 3-19: Scanning Electromicrograph
Cut Marks on Frontal Bone
Magnification: X 163

Figure 3-20: Scanning Electromicrograph
Cut Marks on Frontal Bone
Magnification: X 50.5

Figure 3-21: Scanning Electromicrograph
Cut Marks on Frontal Bone
Magnification: X 50.5

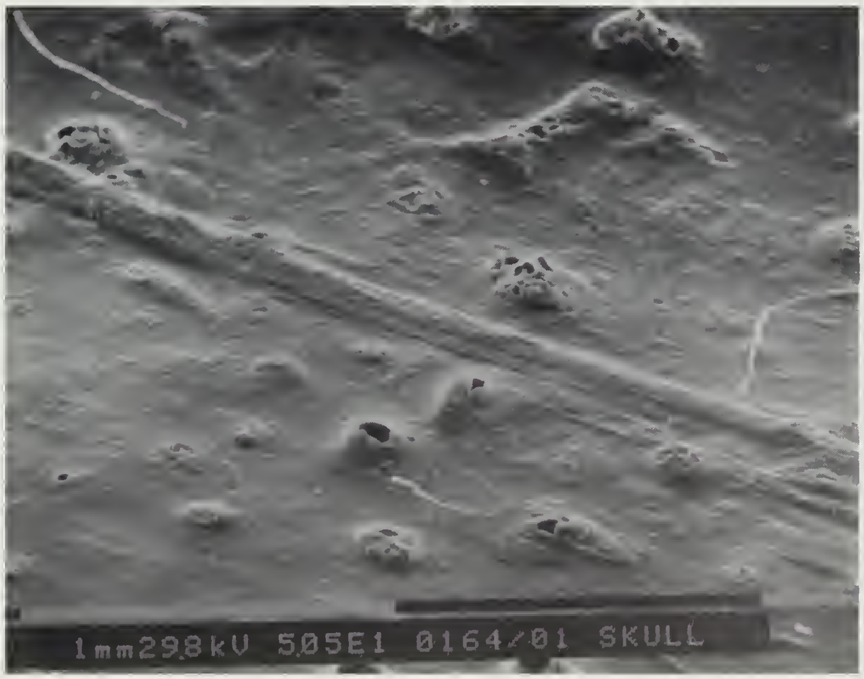


Figure 3-22: Scanning Electromicrograph
Cut Marks on Frontal Bone
Magnification; X 50.5

Figure 3-23: Scanning Electromicrograph
Cut Marks on Frontal Bone
Magnification: X 50.5

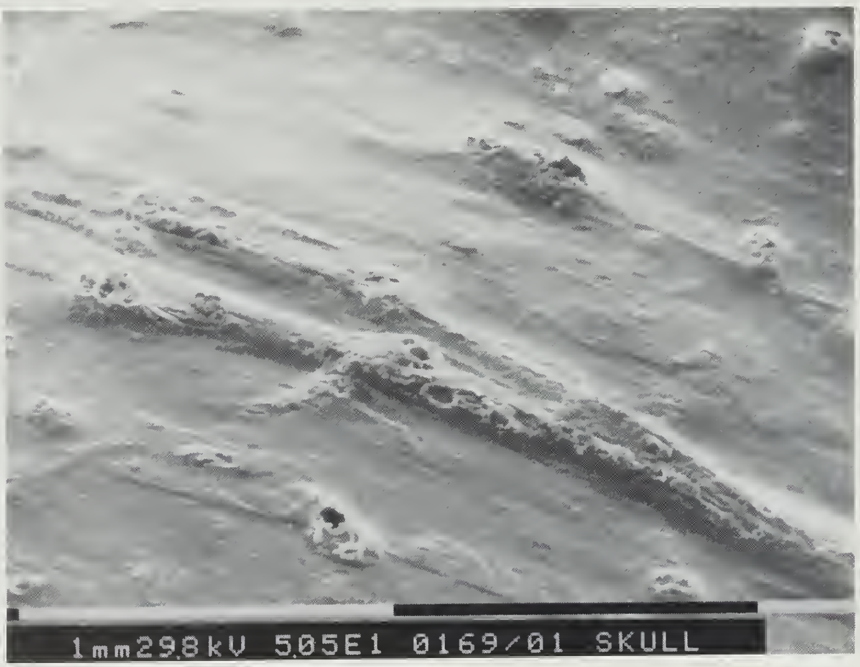


Figure 3-24: Scanning Electromicrograph
Cut Marks on Frontal Bone
Magnification: X 50.5

Figure 3-25: Scanning Electromicrograph
Cut Marks on Frontal Bone
Magnification: X 50.5

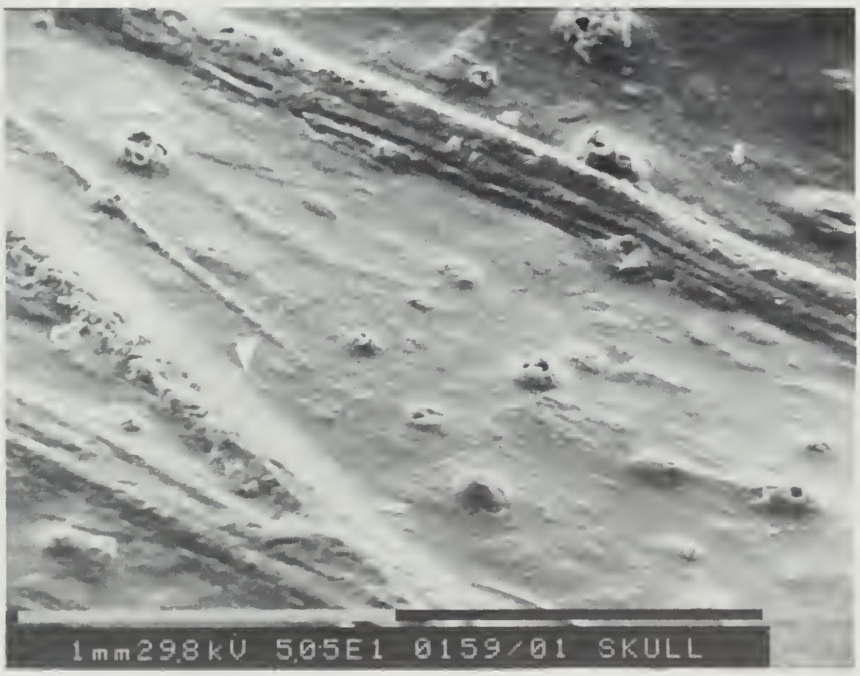


Figure 3-26: Scanning Electromicrograph
Cut Marks on Frontal Bone
Magnification: X 50.5

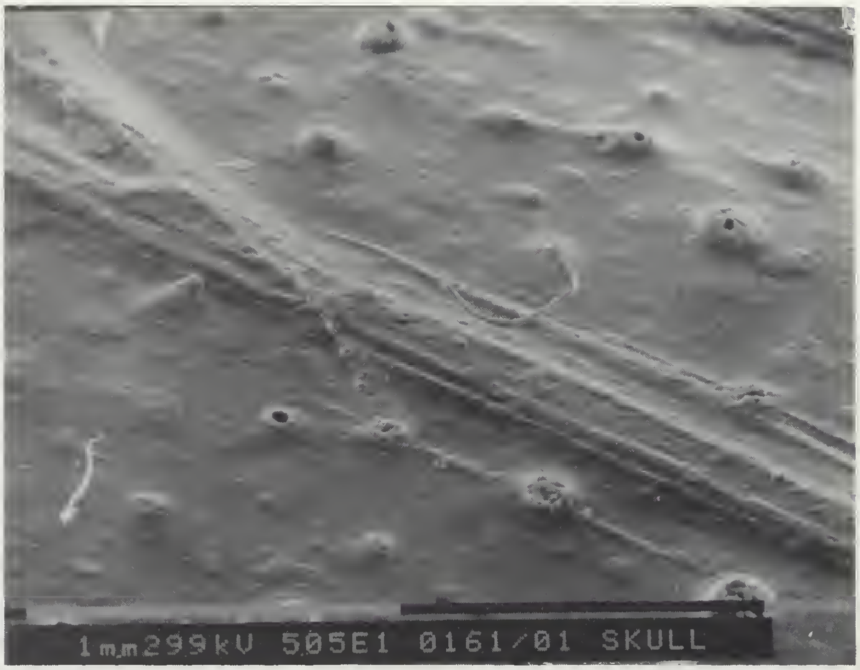


Figure 3-27: Scanning Electromicrograph
Cut Marks on Frontal Bone
Magnification: X 50.5

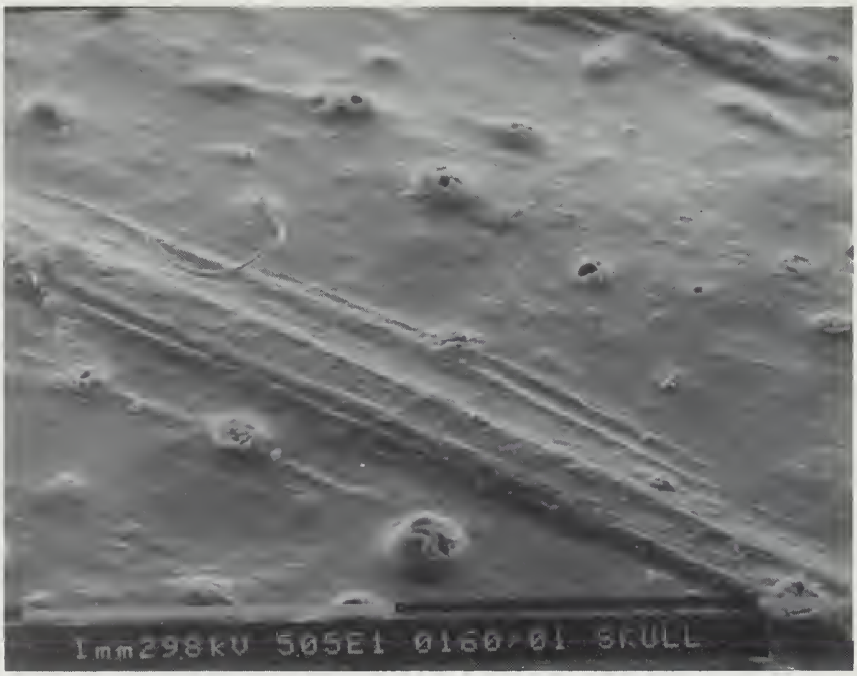


Figure 3-28: Scanning Electromicrograph
Cut Marks on Frontal Bone
Magnification: X-50.5

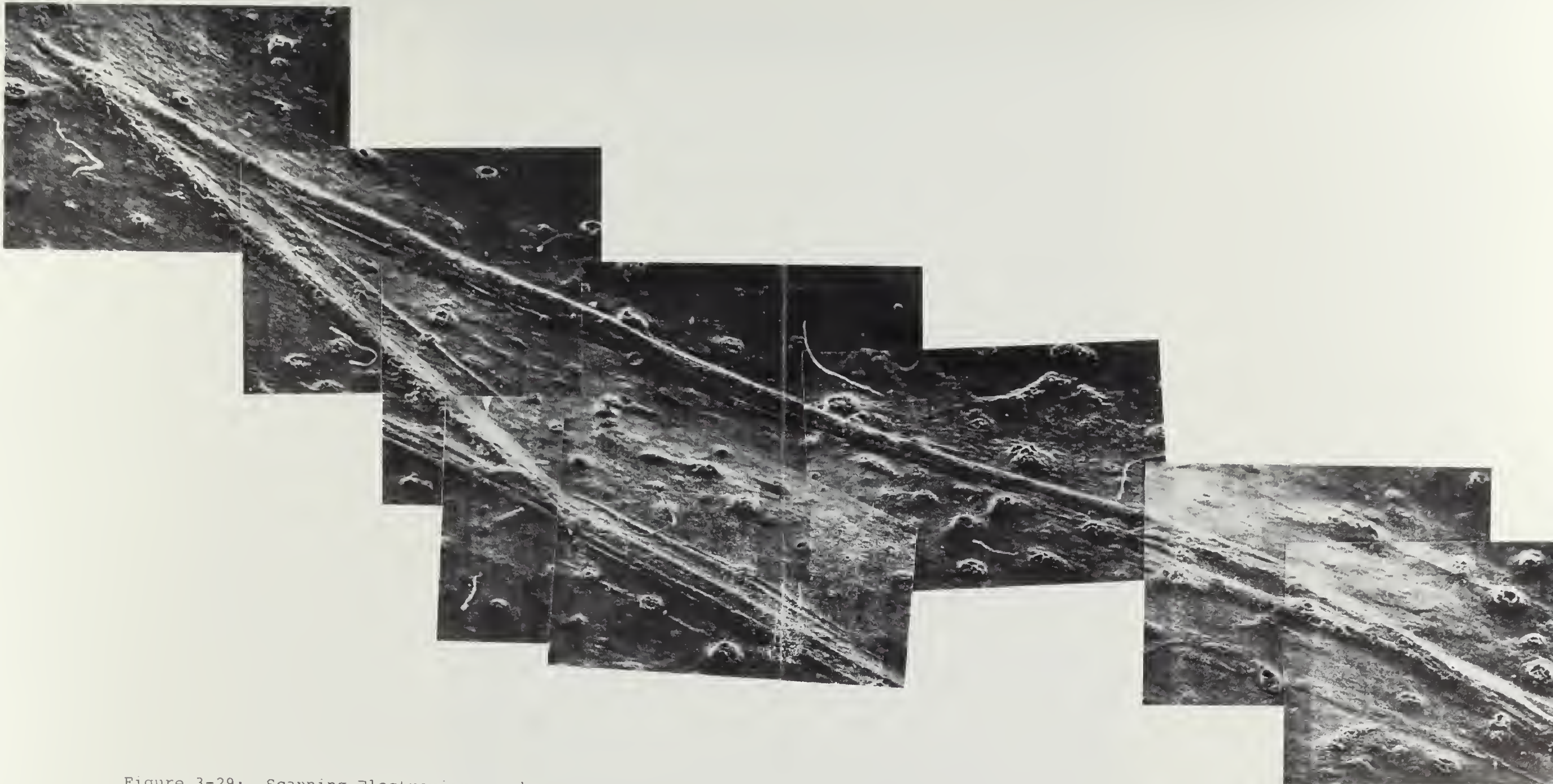


Figure 3-29: Scanning Electromicrograph
Cut Marks on Frontal Bone
Magnification: X 50.5

Figures 3-20 through 3-28 arranged to show continuous line of cut mark

0 1 2 3 4 5 6 7 8 9 10
Centimeters Reduced to 67%

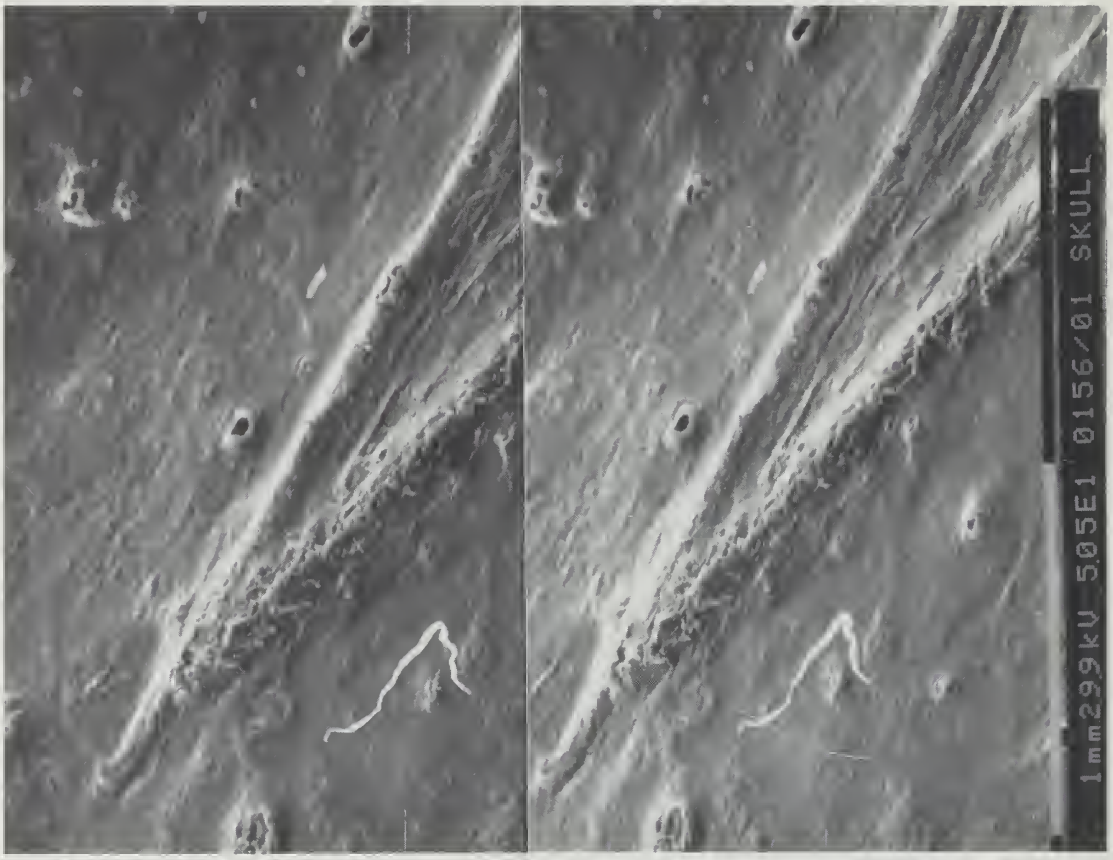


Figure 3-30: Scanning Electromicrograph, Stereopairs
Cut Marks on Frontal Bone
Magnification: X 50.5

Figure 3-31: Scanning Electromicrograph, Stereopairs
Cut Marks on Frontal Bone
Magnification: X 23.2

Figure 3-32: Mandible

Figure 3-33: Mandible

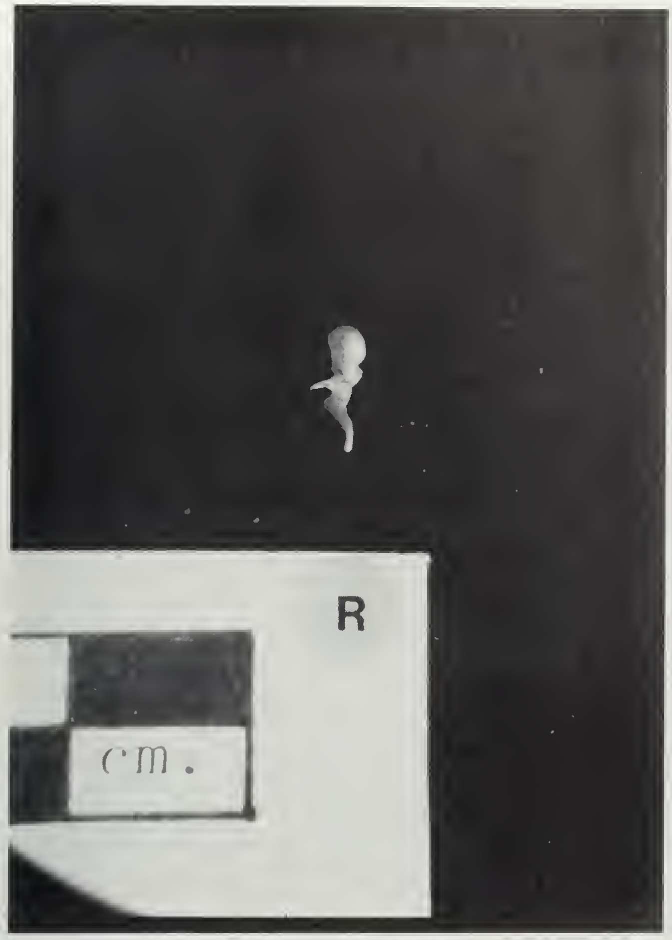


Figure 3-34: Right Malleus
(Ear Ossicle: Hammer)

Figure 3-35: Right Malleus
(Ear Ossicle: Hammer)

Figure 3-36: Manubrium, Ventral (Anterior) View

Figure 3-37: Manubrium, Dorsal (Posterior) View

Figure 3-38: Left Scapula, Dorsal (Posterior) View

Figure 3-39: Left Scapula, Ventral (Anterior) View

Figure 3-40: Right Scapula, Dorsal (Posterior) View

Figure 3-41: Right Scapula, Ventral (Anterior) View

Figure 3-42: Left Scapula, Glenoid Fossa

Figure 3-43: Right Scapula, Glenoid Fossa

Figure 3-44: Left Clavicle, Superior View

Figure 3-45: Left Clavicle, Inferior View

Figure 3-46: Right Clavicle, Superior View

Figure 3-47: Right Clavicle, Inferior View

Figure 3-48: Right, Left Humerus, Anterior View

Figure 3-49: Right, Left Humerus, Posteror View

Figure 3-50: Left Radius, Ulna, Anterior View

Figure 3-51: Left Radius, Ulna, Posterior View

Figure 3-52: Left Radius, Ulna, Medial View

Figure 3-53: Left Radius, Ulna, Lateral View

Figure 3-54: Right Radius, Ulna, Anterior View

Figure 3-55: Right Radius, Ulna, Medial View

Figure 3-56: Right Radius, Ulna, Lateral View

Figure 3-57: Left Hand

Figure 3-58: Left Carpals: Navicular,
Lunate, Triquetral, Capitate

Figure 3-59: Left Carpals: Navicular,
Lunate, Triquetral, Capitate

Figure 3-60: Left Metacarpals and Phalanges, Dorsal View

Figure 3-61: Left Metacarpals and Phalanges, Ventral (Palm) View

Figure 3-62: Left Metacarpals and Phalanges, Lateral View

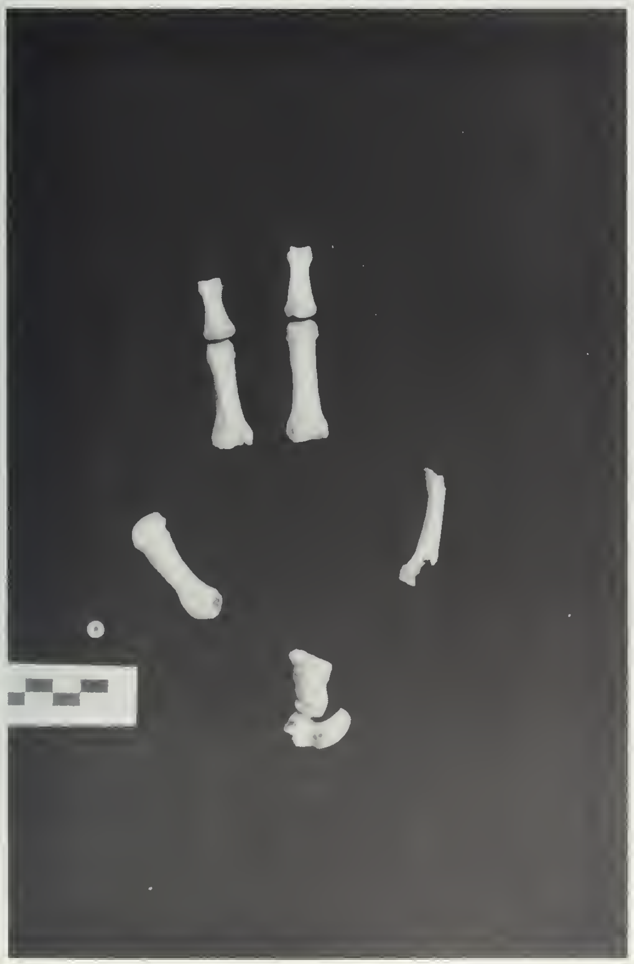


Figure 3-63: Right Hand

Figure 3-64: Right Carpals: Capitate, Navicular

Figure 3-65: Right Carpals: Capitate, Navicular

Figure 3-66: Right Metacarpals and Phalanges, Dorsal View

Figure 3-67: Right Metacarpals and Phalanges, Ventral (Palm) View

Figure 3-68: Right Metacarpals and Phalanges, Lateral View

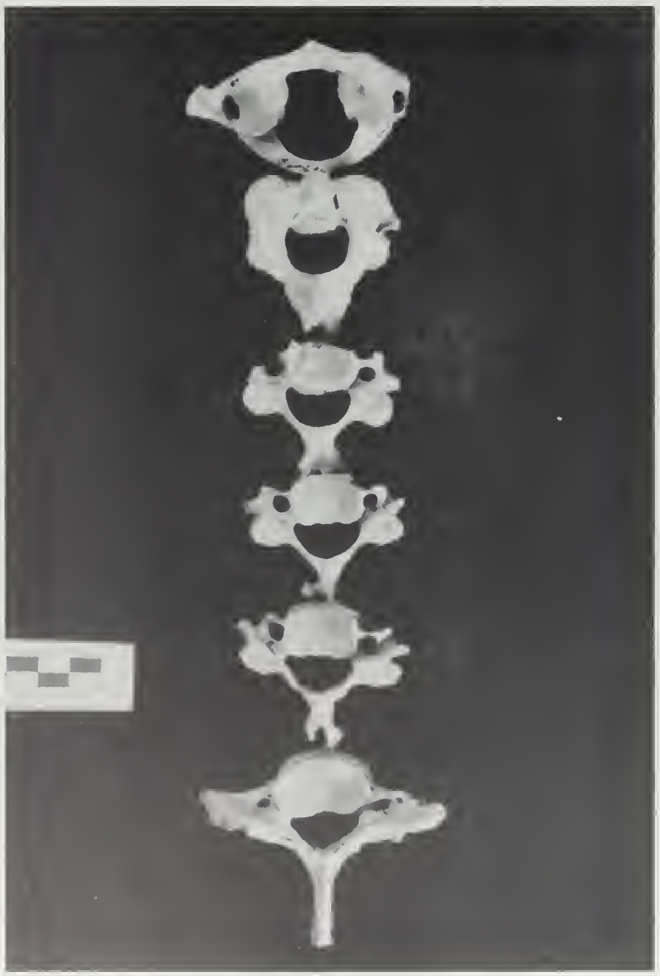


Figure 3-69: Cervical Vertebrae 1-5 and 7 Cranial Views

Figure 3-70: 1st Cervical Vertebra
Cranial View

Figure 3-71: 1st Cervical Vertebra
Caudal View

Figure 3-72: 2nd Cervical Vertebra
Cranial View

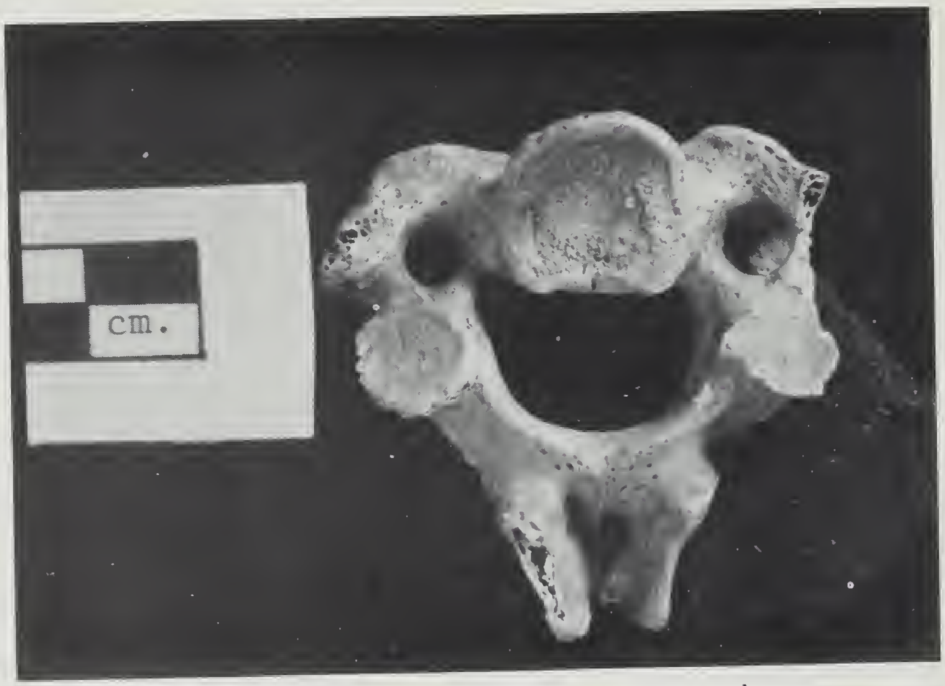


Figure 3-73: 2nd Cervical Vertebra
Caudal View

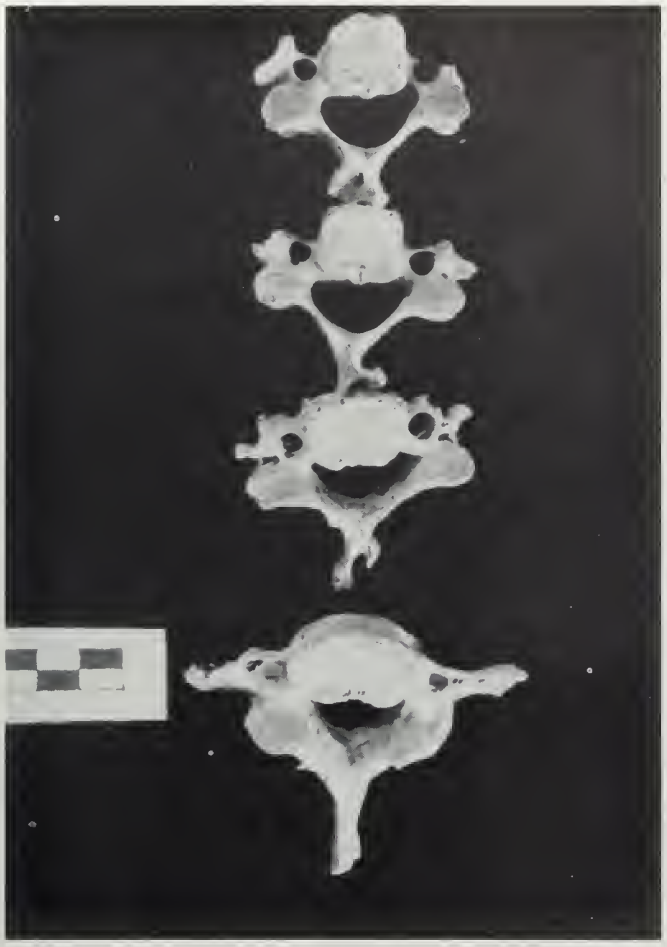


Figure 3-74: Cervical
Vertebrae 3,4,5,7
Caudal View

Figure 3-75: Thoracic
Vertebrae 1-4
Cranial View

Figure 3-76: Thoracic Vertebrae 1-4 Caudal View

Figure 3-77: Thoracic Vertebrae 5-8 Cranial View

Figure 3-78: Thoracic
Vertebrae 5-8
Caudal View

Figure 3-79: Thoracic
Vertebrae 9-12
Cranial View

Figure 3-80: Thoracic Vertebrae 9-12 Caudal View

Figure 3-81: Lumbar Vertebrae 1-3 Cranial View

Figure 3-82: Lumbar
Vertebrae 1-3
Caudal View

Figure 3-83: Lumbar
Vertebrae 4,5
Cranial View

Figure 3-84: Lumbar
Vertebrae 4,5
Caudal View

Figure 3-85: Sacrum
Anterior (Pelvic) View

Figure 3-86: Sacrum
Dorsal View

Figure 3-87: Sacrum
View from Left Side

Figure 3-88: Sacrum
View from Right Side

Figure 3-89: Ribs
Left Side
Cranial View

Figure 3-90: Ribs
Left Side
Caudal View

Figure 3-91: Ribs
Right Side
Cranial View

Figure 3-92: Ribs
Right Side
Close-up of Heads
Caudal View

Figure 3-93: Innominate
Left Side
Lateral View

Figure 3-94: Innominate
Left Side
Medial View

Figure 3-95: Innominate
Right Side
Lateral View

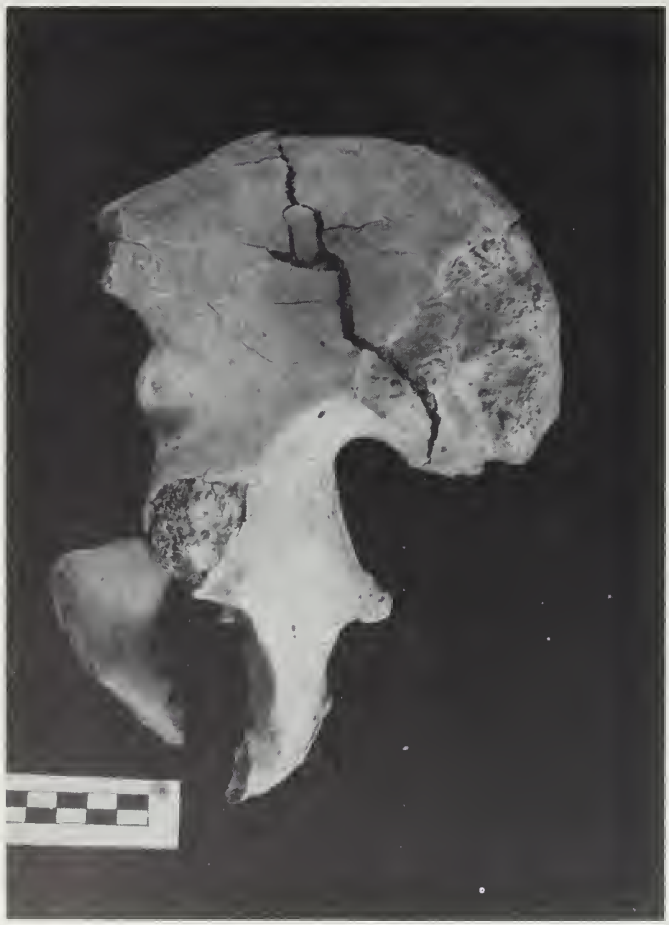


Figure 3-96: Innominate
Right Side
Medial View

Figure 3-97: Innominate
Left Pubic Symphysis

Figure 3-98: Innominate
Right Pubic Symphysis

Figure 3-98: Femora
Right, Left
Anterior View

Figure 3-99: Femora
Right, Left
Posterior View

Figure 3-100: Femora: Left, Right
Anterior-Proximal Close-up

Figure 3-101: Femora: Left, Right
Posterior-Proximal Close-up

Figure 3-102: Femora: Left, Right
Anterior-Distal Close-up

Figure 3-103: Femora: Left, Right
Posterior-Distal Close-up

Figure 3-104: Left Femur
Distal Condyles Close-up

Figure 3-105: Right Femur
Distal Condyles Close-up

Figure 3-106: Left Patella
Anterior View

Figure 3-107: Left Patella
Posterior View

Figure 3-108: Tibiae
Left, Right
Anterior View

Figure 3-109: Tibiae
Left, Right
Posterior View

Figure 3-110: Left Tibia
Condylar Surface

Figure 3-111: Right Tibia
Condylar Surface

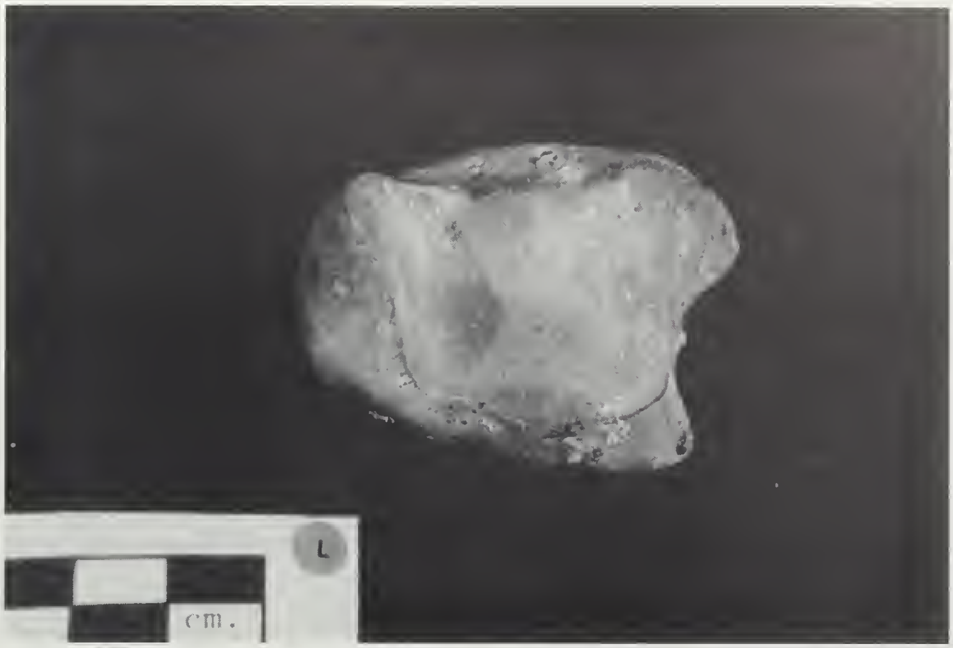


Figure 3-112: Left Tibia
Distal Articular Surface

Figure 3-113: Right Tibia
Distal Articular Surface

Figure 3-114: Fibulae
Left, Right
Anterior View

Figure 3-115: Fibulae
Left, Right
Posterior View

Figure 3-116: Left Foot

Figure 3-117: Right Foot

Figure 3-118: Left Calcaneus

Figure 3-119: Left Calcaneus

Figure 3-120: Left Calcaneus

Figure 3-121: Left Talus

Figure 3-122: Left Talus

Figure 3-123: Left Talus

Figure 3-124: Left
Navicular

Figure 3-125: Left
1st Cuneiform

Figure 3-126: Left
1st Cuneiform

Figure 3-127:Left
2nd Cuneiform (bottom)
3rd Cuneiform (top)
[note lesion on 3rd]

Figure 3-128: Left
2nd Cuneiform (bottom)
3rd Cuneiform (top)

Figure 3-129: Left
2nd Cuneiform (bottom)
3rd Cuneiform (top)

Figure 3-130: Left Cuboid

Figure 3-131: Left Cuboid

Figure 3-132: Left
Cuboid

Figure 3-133: Left
1st Metatarsal Close-up
of rodent marks

Figure 3-134: Left 1-4 Metatarsals
[rodent marks on #1)

Figure 3-135: Left 1-4 Metatarsals
[rodent marks on #1)

Figure 3-136: Left Phalanges

Figure 3-137: Right Phalanges

Figure 3-138: Rib Fragments

Figure 3-139: Cranial Fragments

Figure 3-140:
Innominate Fragments

Figure 3-141:
Miscellaneous
Bone Fragments

Figure 3-142: Nonhuman Bone

Figure 3-143: Nonhuman Bone

Figure 3-144: X-ray Cranium Anterior View

Figure 3-145: X-ray Cranium Anterior View

Figure 3-146: X-ray Cranium Lateral View

Figure 3-147: X-ray Cranium Lateral View

Figure 3-148: X-ray
Cranium Caudal View

Figure 3-149: X-ray
Cranium Caudal View

Figure 3-150: X-ray Mandible

Figure 3-151: X-ray Humeri, Radii, Ulnae Anterior Views

Figure 3-152: X-ray
Humeri, Radii, Ulnae
Lateral Views

Figure 3-153: X-ray
Vertebrae
Cranial View

C1	T1	T6	T11	L3
C2	T2	T7	T12	L4
C3	T3	T8	L1	L5
C4	T4	T9	L2	Col
C5	T5	T10		
C7				

Figure 3-154: X-ray
Vertebrae
Lateral View

C7	T5	T10	L2	Col
C5	T4	T9	L1	L5
C4	T3	T8	T12	L4
C3	T2	T7	T11	L3
C2	T1	T6		
C1				

Figure 3-155: X-ray
Left Ribs and
Innominate Frags.
[Large Frag. is Rt.
Pubis Frag]

Figure 3-156: X-ray
Right Ribs

Figure 3-157: X-ray
Innominates Anterior View
Sacrum Lateral View
Mandible Cranial View

Figure 3-158: X-ray
Innominates Lateral View
Sacrum Anterior View

Figure 3-159: X-ray
Left Femur and Tibia
Anterior View

Figure 3-160: X-ray
Left Femur and Tibia
Lateral View

Figure 3-161: X-ray
Right Femur and Tibia
Anterior View

Figure 3-162: X-ray
Right Femur and Tibia
Lateral View

Figure 3-163: X-ray
Fibulae, Posterior View
Scapulae, Lateral View
Clavicles, Anterior View
Patella, Anterior View

Figure 3-164: X-ray
Fibulae, Lateral View
Scapulae, Posterior View
Clavicles, Cranial View
Manubrium & Patella,
Anterior View

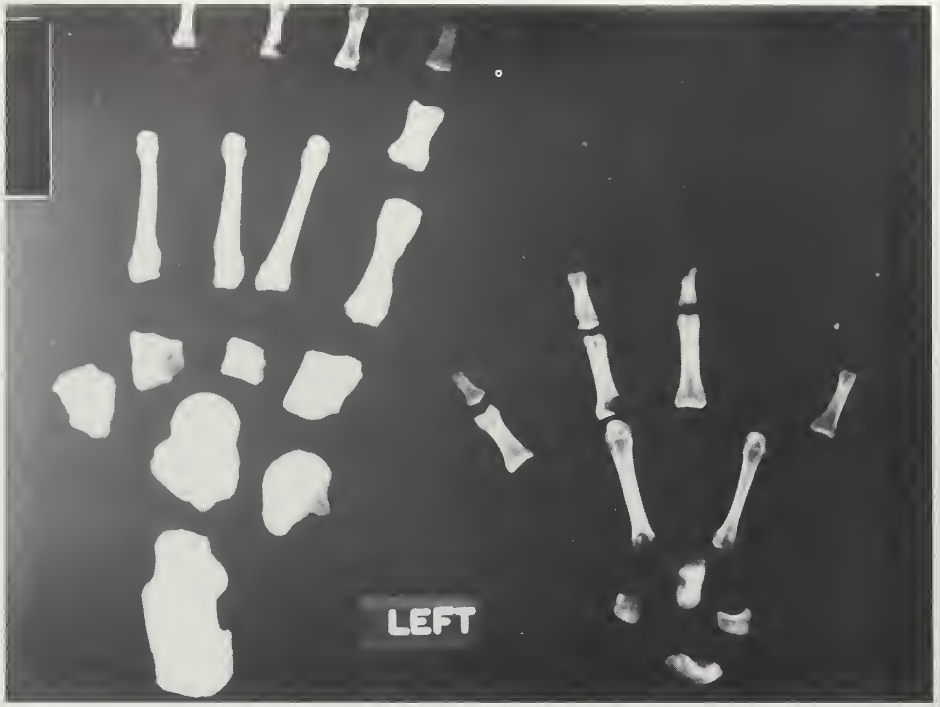


Figure 3-165: X-ray Left Hand and Foot
Anterior View

Figure 3-166: X-ray Left Hand and Foot
Lateral View

Figure 3-167: X-ray Right Hand and Foot
Anterior View

Figure 3-168: X-ray Right Hand and Foot
Lateral View

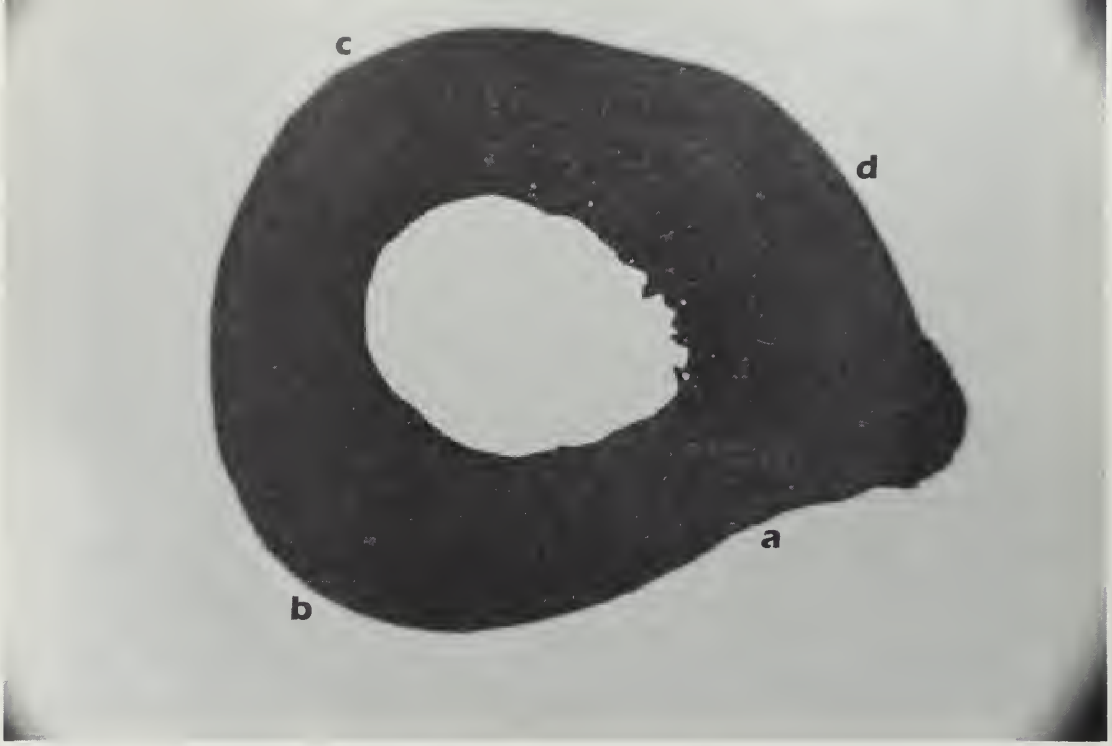


Figure 3-169: Cross-Section of Midshaft, Left Femur
Arrows Designate Locations of Following
Microscopic Photographs

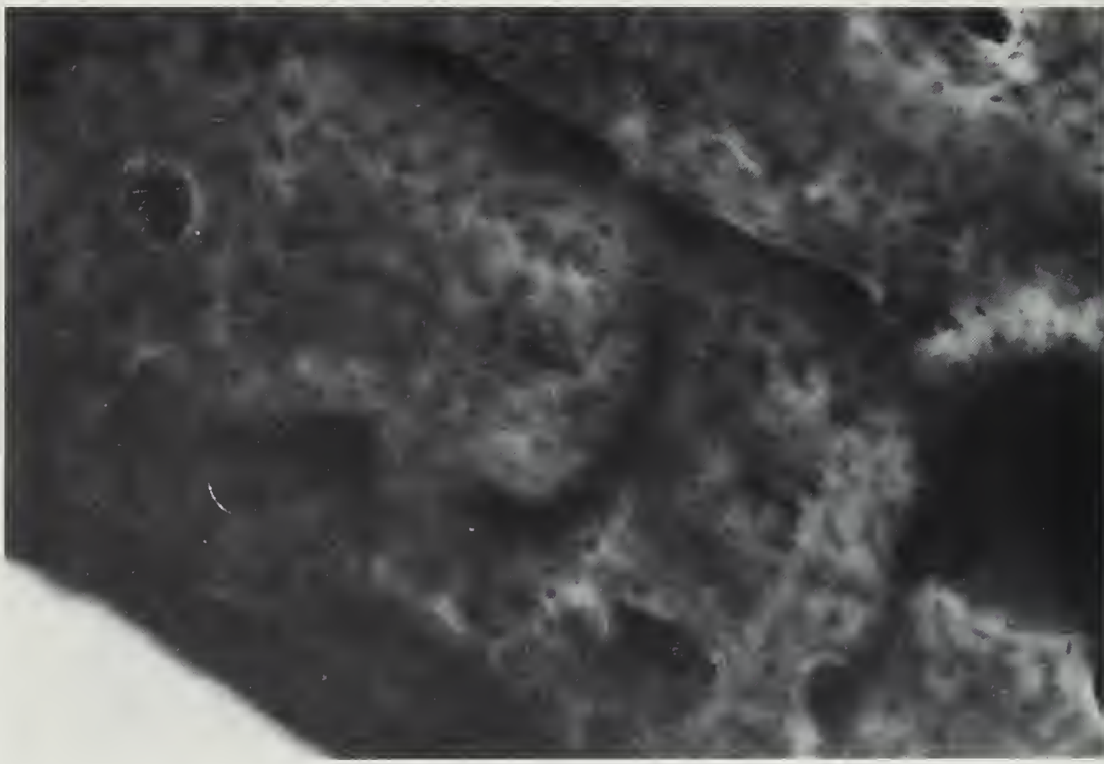


Figure 3-170: Cross-Section of Left Femur,
Location A, Magnification: 100X
Actual Measurement of Photo Approximately .2mm X .3mm

Figure 3-171: Cross-Section of Left Femur,
Location B, Magnification: 100X
Actual Measurement of Photo Approximately .2mm X .3mm

Figure 3-172: Cross-Section of Left Femur,
Location C, Magnification: 100X
Actual Measurement of Photo Approximately .2mm X .3mm

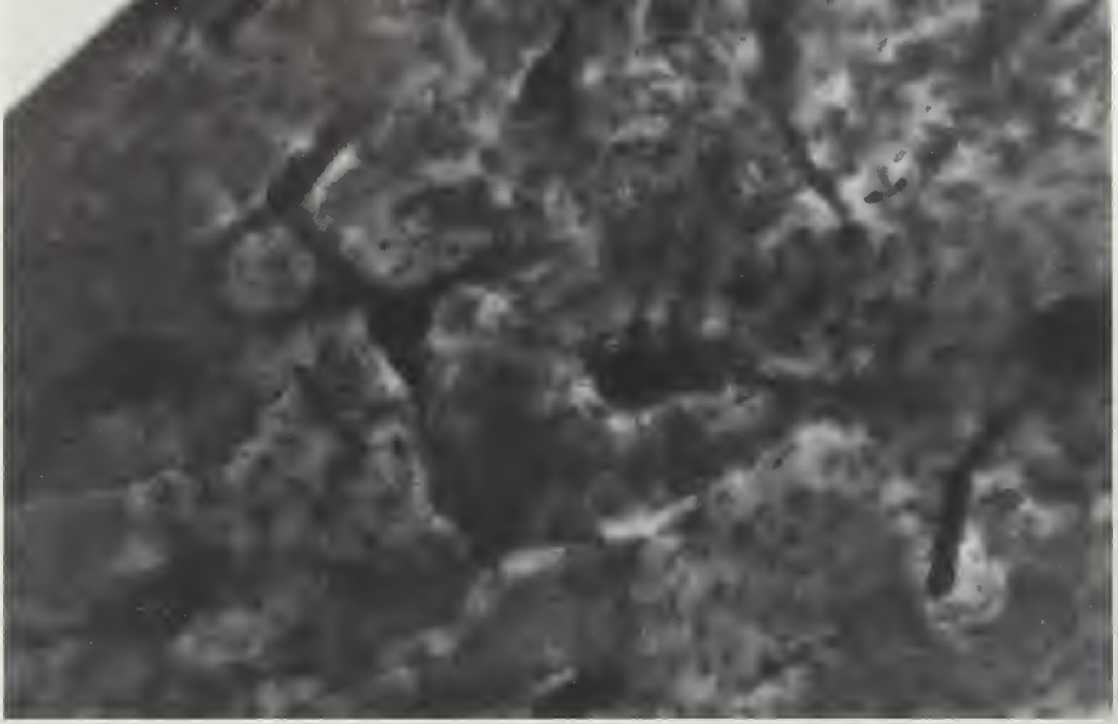


Figure 3-173: Cross-Section of Left Femur,
Location D, Magnification: 100X
Actual Measurement of Photo Approximately .2mm X .3mm

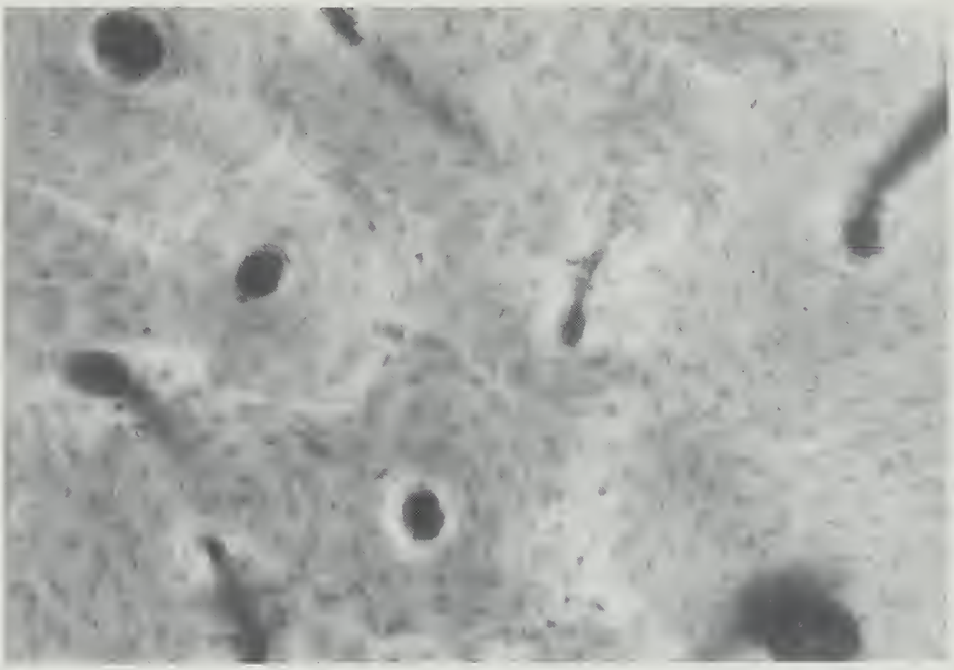


Figure 3-174: Cross-Section of Left Femur,
Black & White Photograph
Magnification: 100X

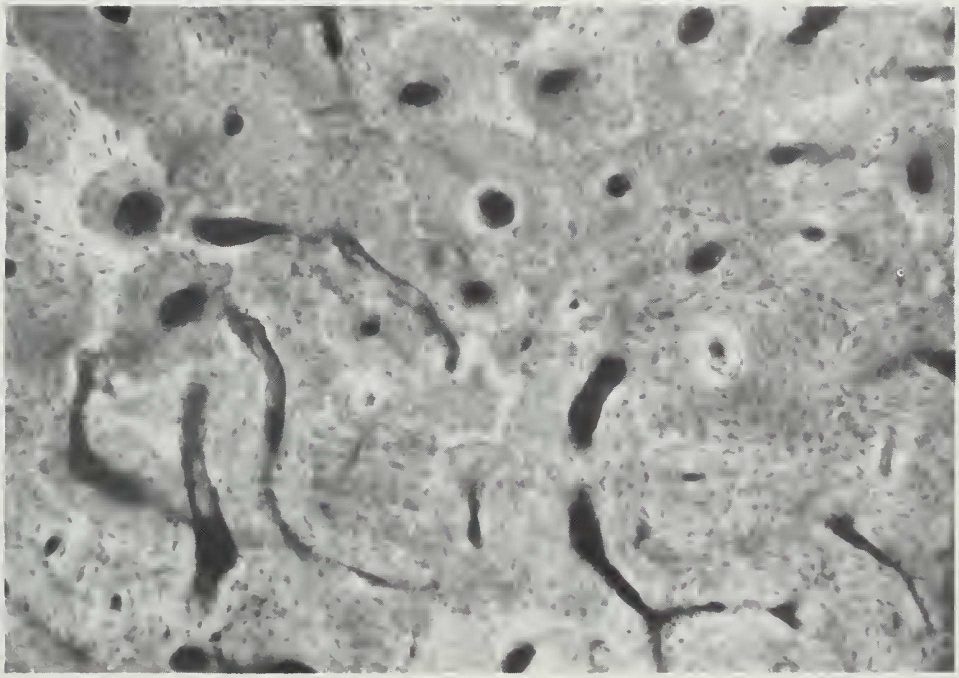
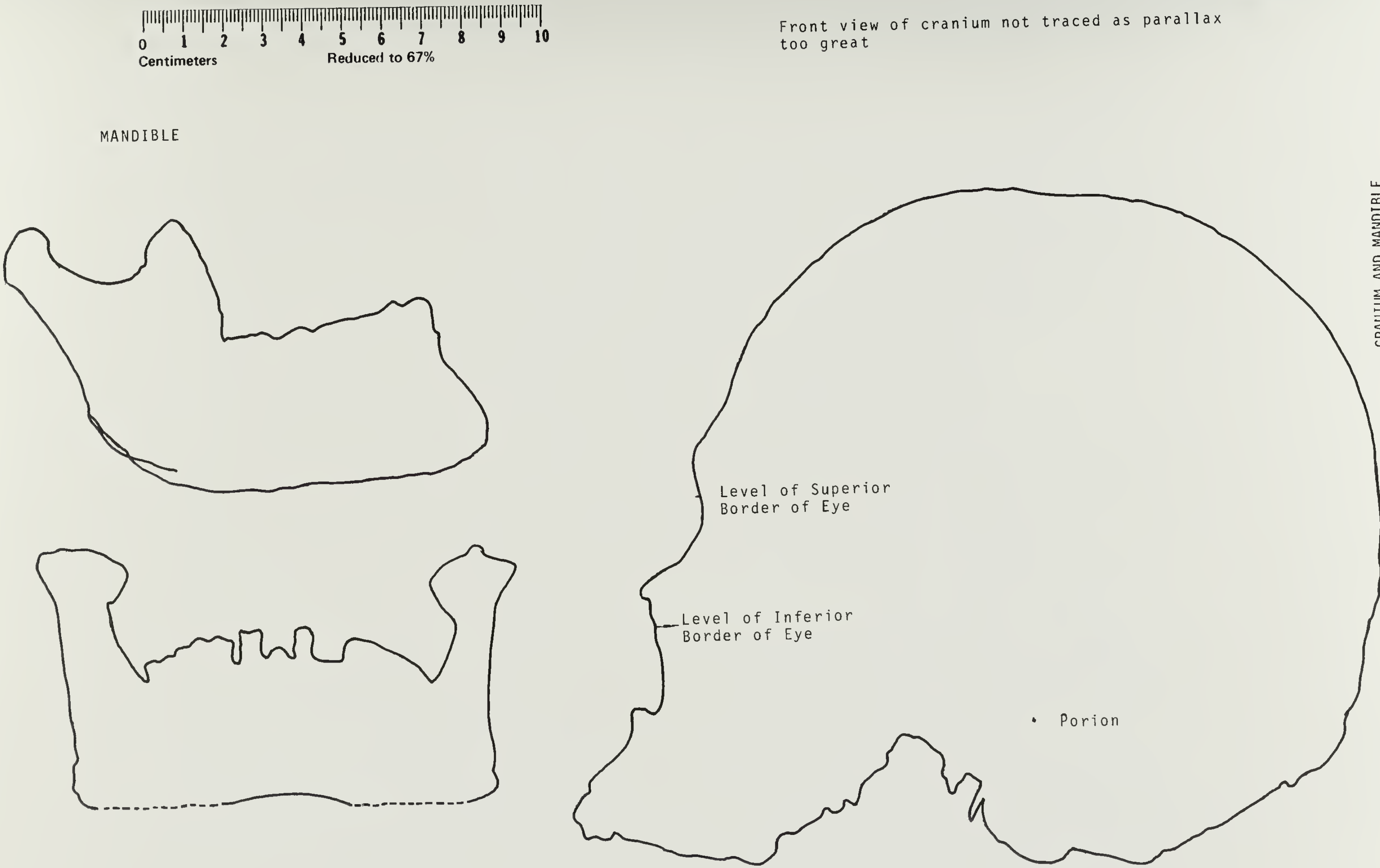


Figure 3-175: Cross-Section of Left Femur,
Black & White Photograph
Magnification: 50X

SHARP-SHADOW TRACINGS

Because it is usually difficult to measure angles of a bone, sharp-shadow tracing is used to reduce much of the information contained within a bone to a single plane. A piece of plate glass on which a piece of graph paper is taped is supported on a table with brackets. The light source, a photo-flood light fixture containing a 150-watt bulb, is placed 20 feet from the glass at the same height above the floor. The bone to be traced is placed on the side of the glass nearest the light source, the graph paper is on the opposite side of the glass. In this way, the light throws a sharp shadow of the bone onto the graph paper.

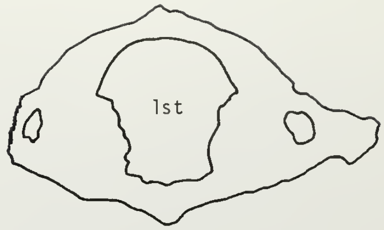


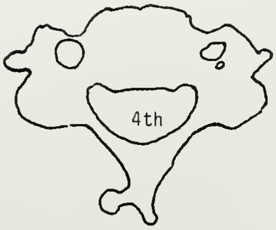
Front view of cranium not traced as parallax too great

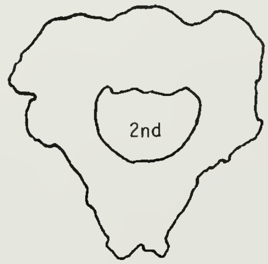
CRANIUM AND MANDIBLE

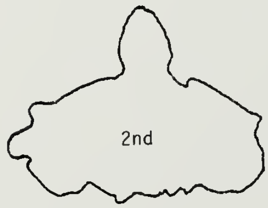
Sharp Shadow Tracings IV-2

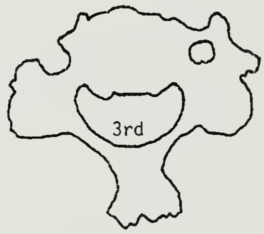
All cervical vertebrae, except 2nd
have superior surface to glass

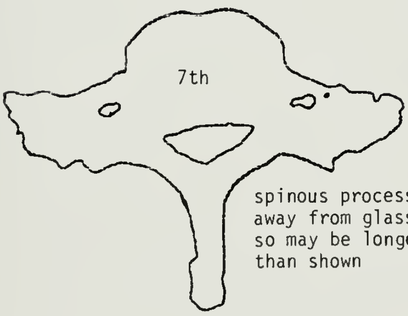




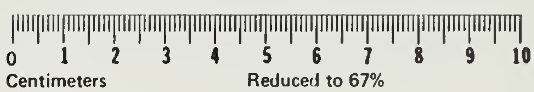




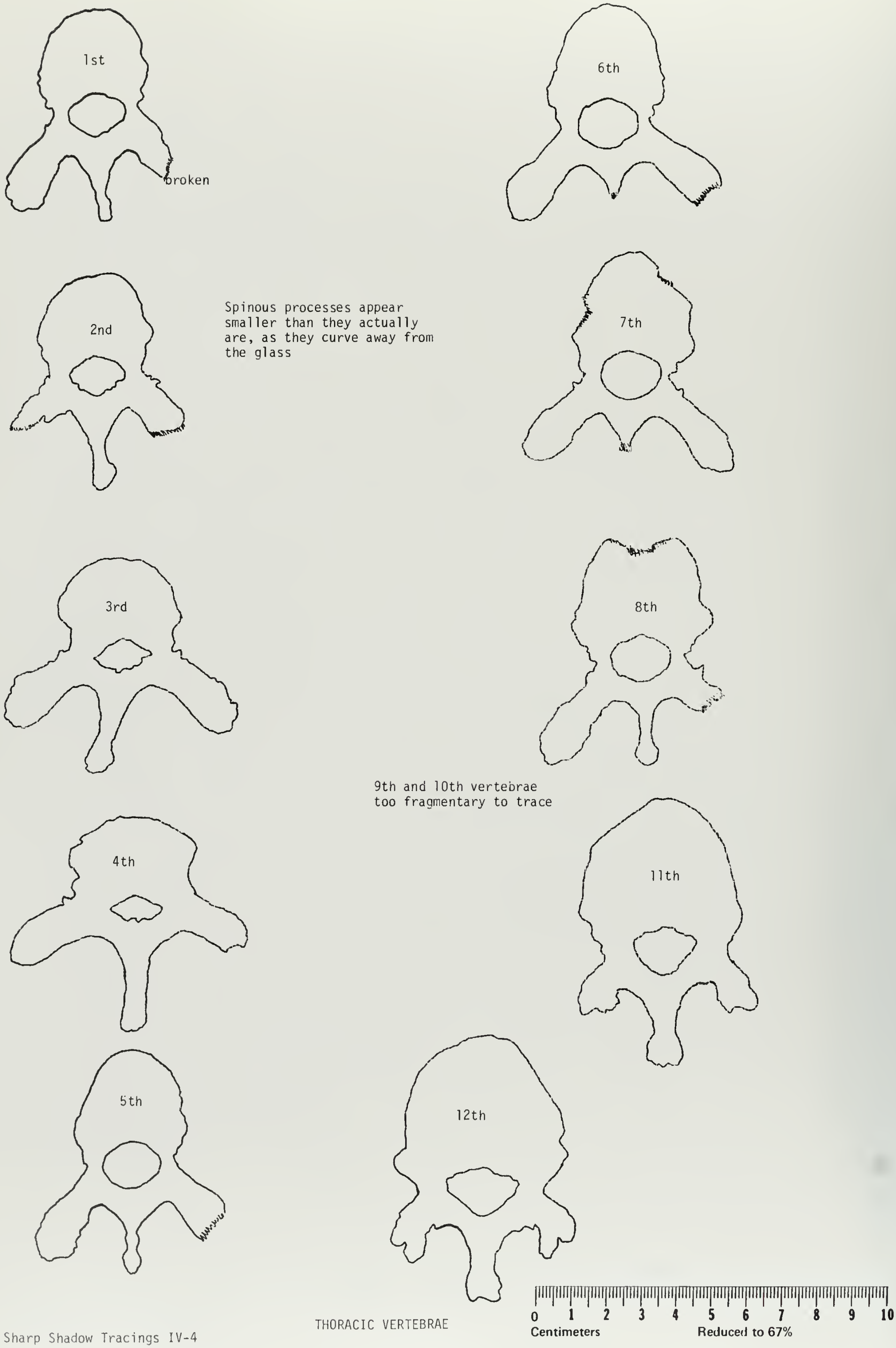




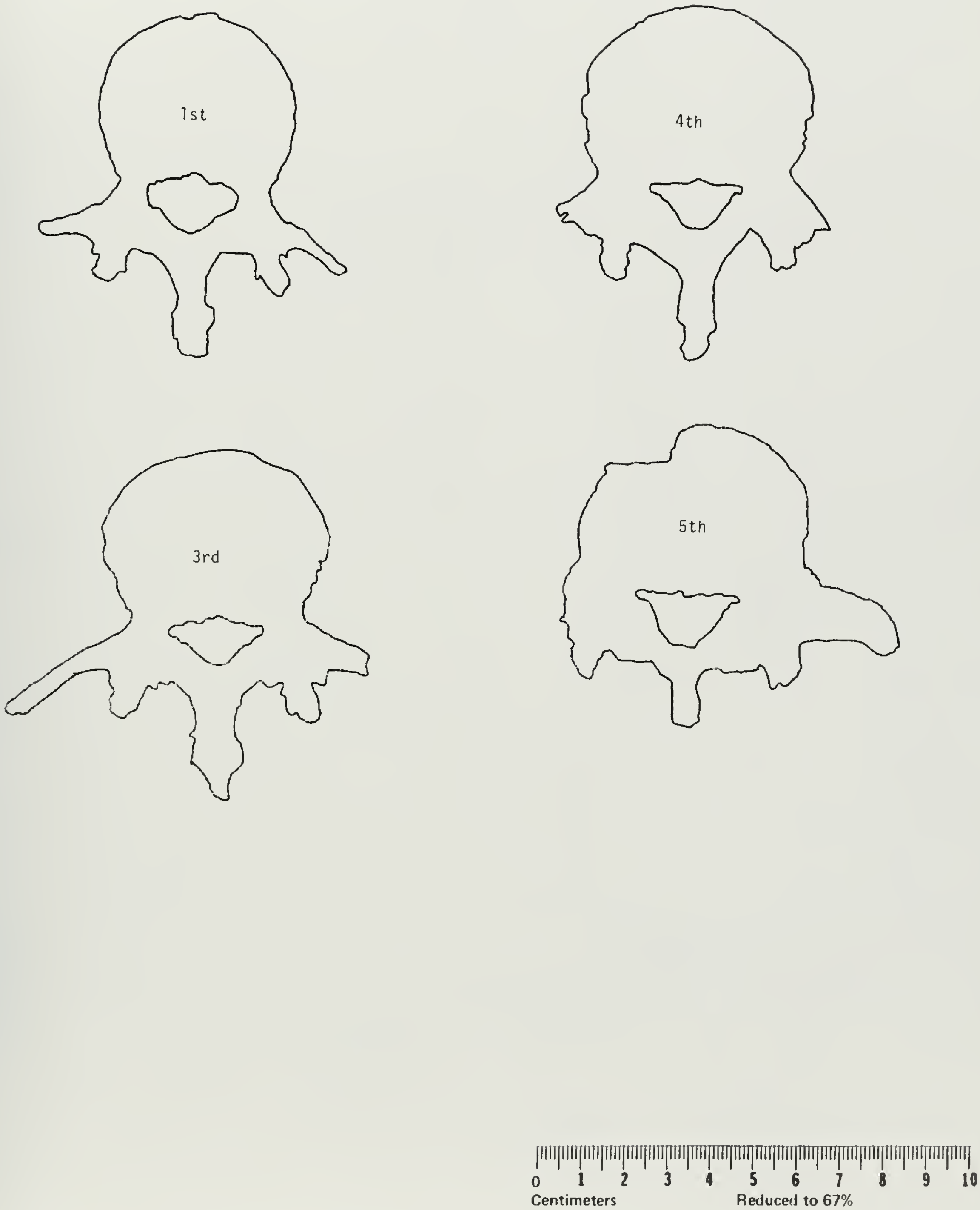
spinous process
away from glass
so may be longer
than shown



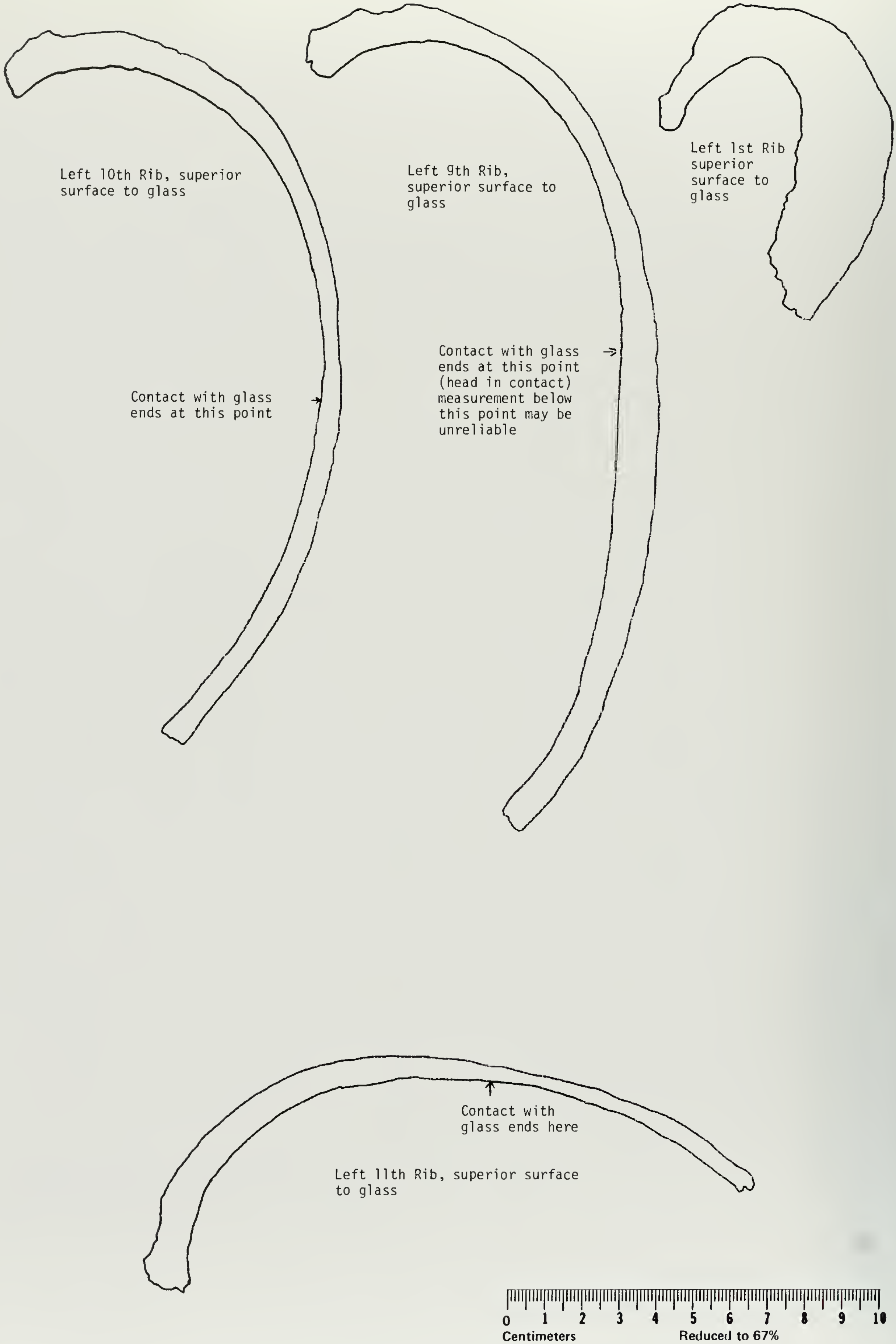
CERVICAL VERTEBRAE



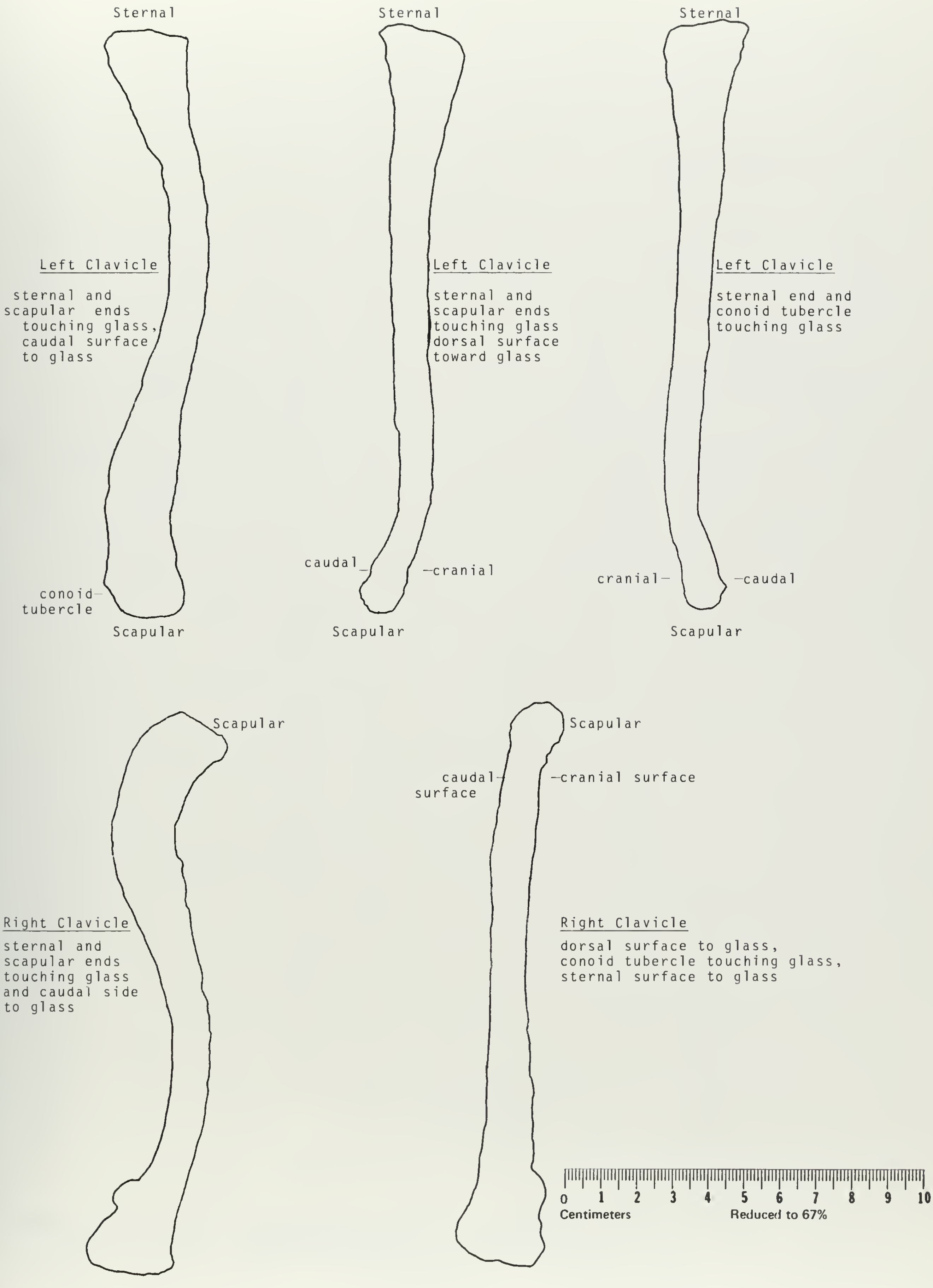
THORACIC VERTEBRAE



LUMBAR VERTEBRAE


Left 10th Rib, superior surface to glass
Left 9th Rib, superior surface to glass
Left 1st Rib superior surface to glass
Contact with glass ends at this point
Contact with glass ends at this point (head in contact) measurement below this point may be unreliable
Contact with glass ends here
Left 11th Rib, superior surface to glass
0 1 2 3 4 5 6 7 8 9 10
Centimeters
Reduced to 67%

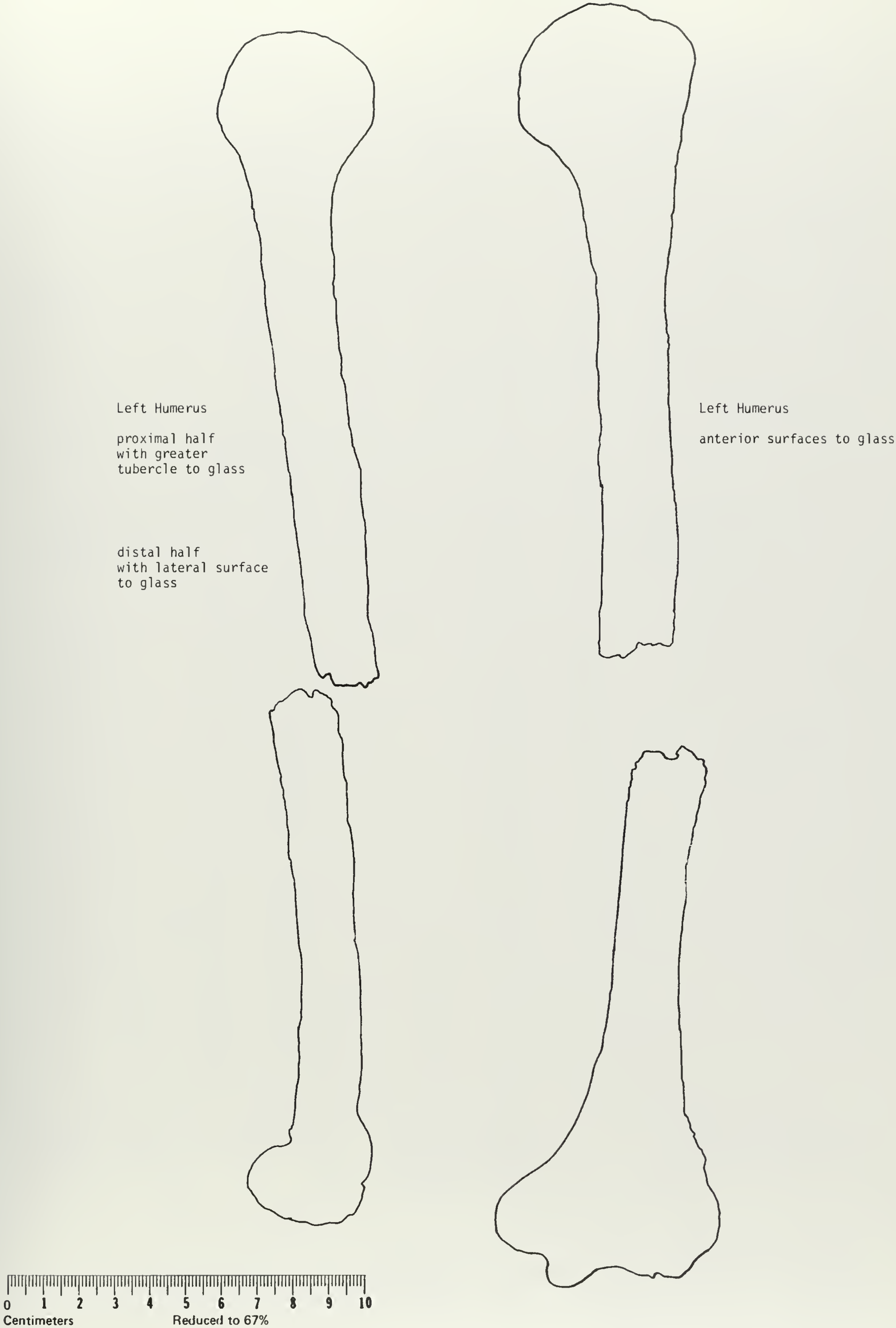
LEFT RIBS


Sternal
Sternal
Sternal
Left Clavicle
sternal and scapular ends touching glass, caudal surface to glass
Left Clavicle
sternal and scapular ends touching glass dorsal surface toward glass
Left Clavicle
sternal end and conoid tubercle touching glass
conoid tubercle
caudal
cranial
cranial
caudal
Scapular
Scapular
Scapular
Scapular
Scapular
caudal surface
cranial surface
Right Clavicle
sternal and scapular ends touching glass and caudal side to glass
Right Clavicle
dorsal surface to glass, conoid tubercle touching glass, sternal surface to glass
0 1 2 3 4 5 6 7 8 9 10
Centimeters
Reduced to 67%

CLAVICLES


Left Scapula; anterior surfaces touching glass
Left Scapula; as much as possible, acromion and coracoid processes touching glass
Right Scapula; anterior surfaces touching glass
Right Scapula; coracoid and acromion processes touching glass
0 1 2 3 4 5 6 7 8 9 10
Centimeters
Reduced to 67%

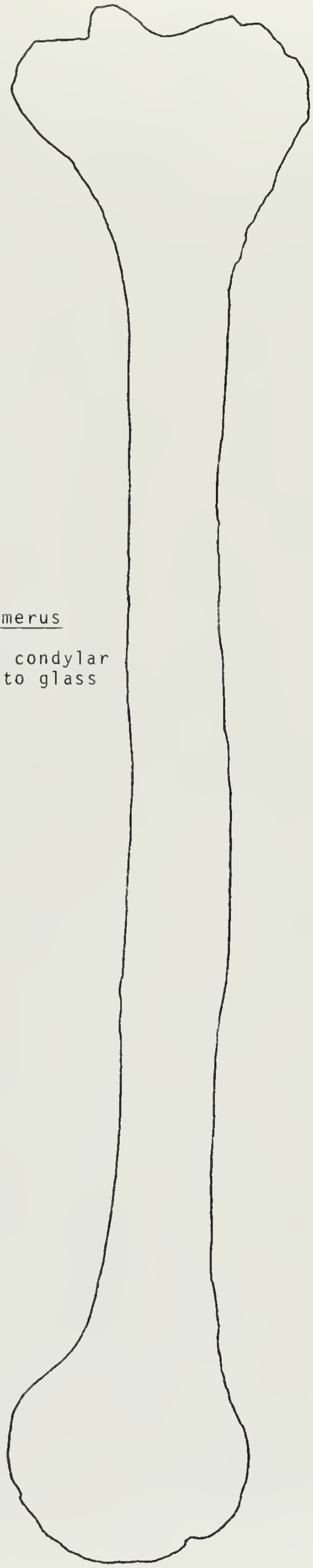
SCAPULAE



LEFT HUMERUS

Right Humerus

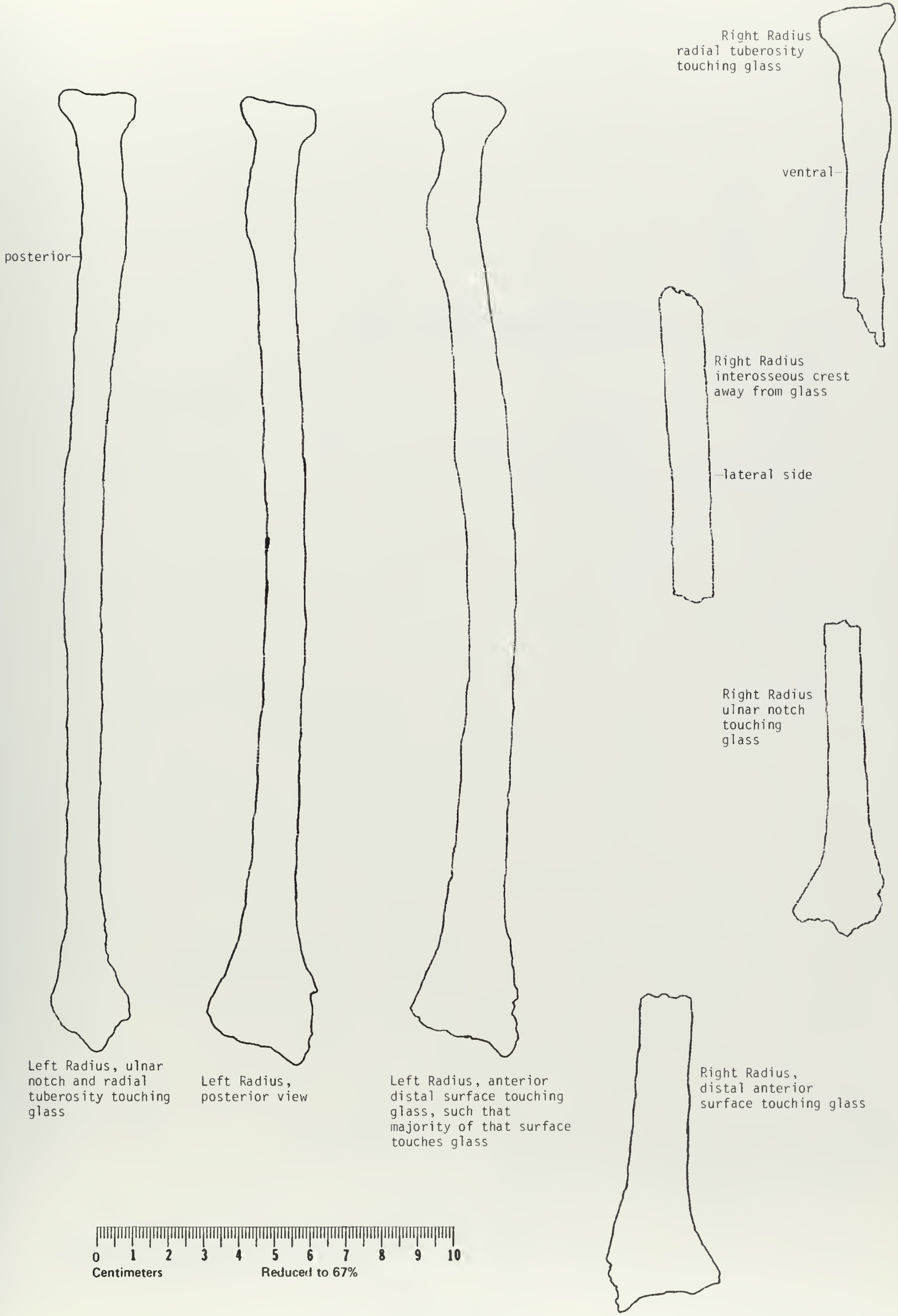
anterior condylar surface to glass



Right Humerus

lateral surface to glass

RIGHT HUMERUS



LEFT AND RIGHT RADII

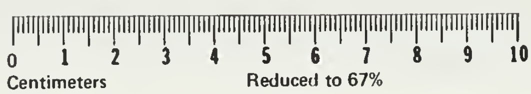
Left Ulna, radial notch touching glass, distal surface touching glass

Left Ulna, posterior view distal surface touching glass

Right Ulna, posterior view distal surface touching glass

Right Ulna, radial notch and distal surface touching glass

LEFT AND RIGHT ULNAE

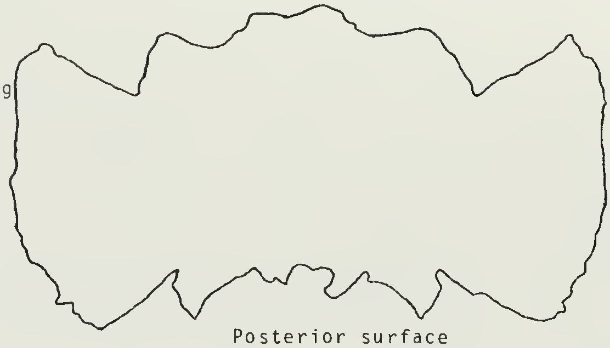


Ordinary view with pubic ramus parallel to glass could not be done because of the fragmentary nature of these bones

LEFT AND RIGHT INNOMINATA

Anterior surface

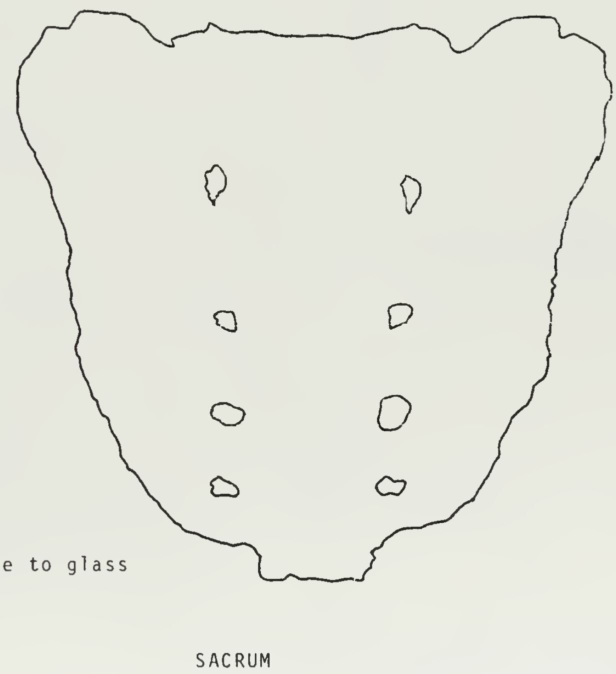
Promontory touching
glass as much as
possible



Posterior surface

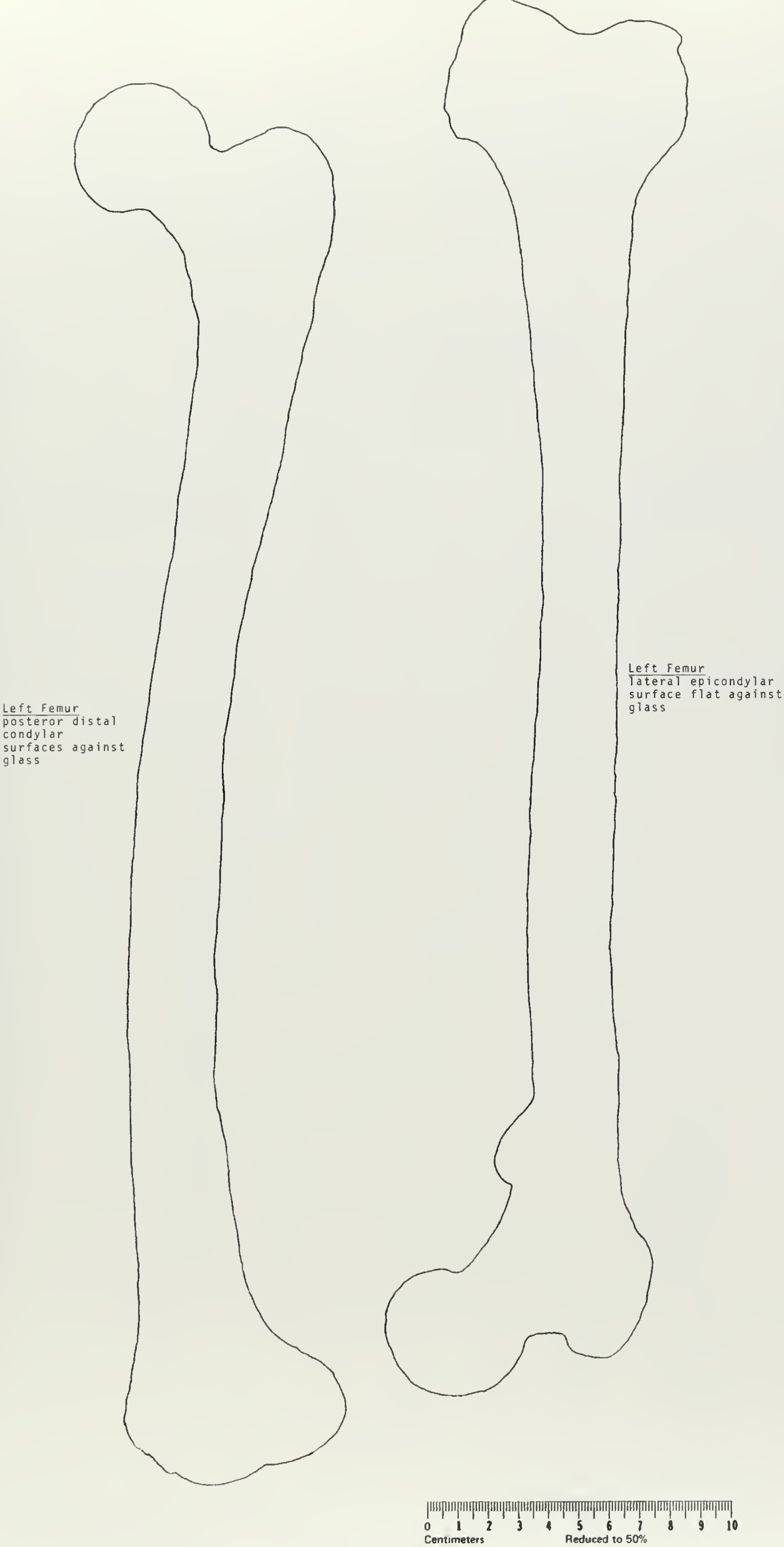
Anterior of left
ala touching glass;
proximal surface
more to glass than
distal surface

Anterior alae to
glass

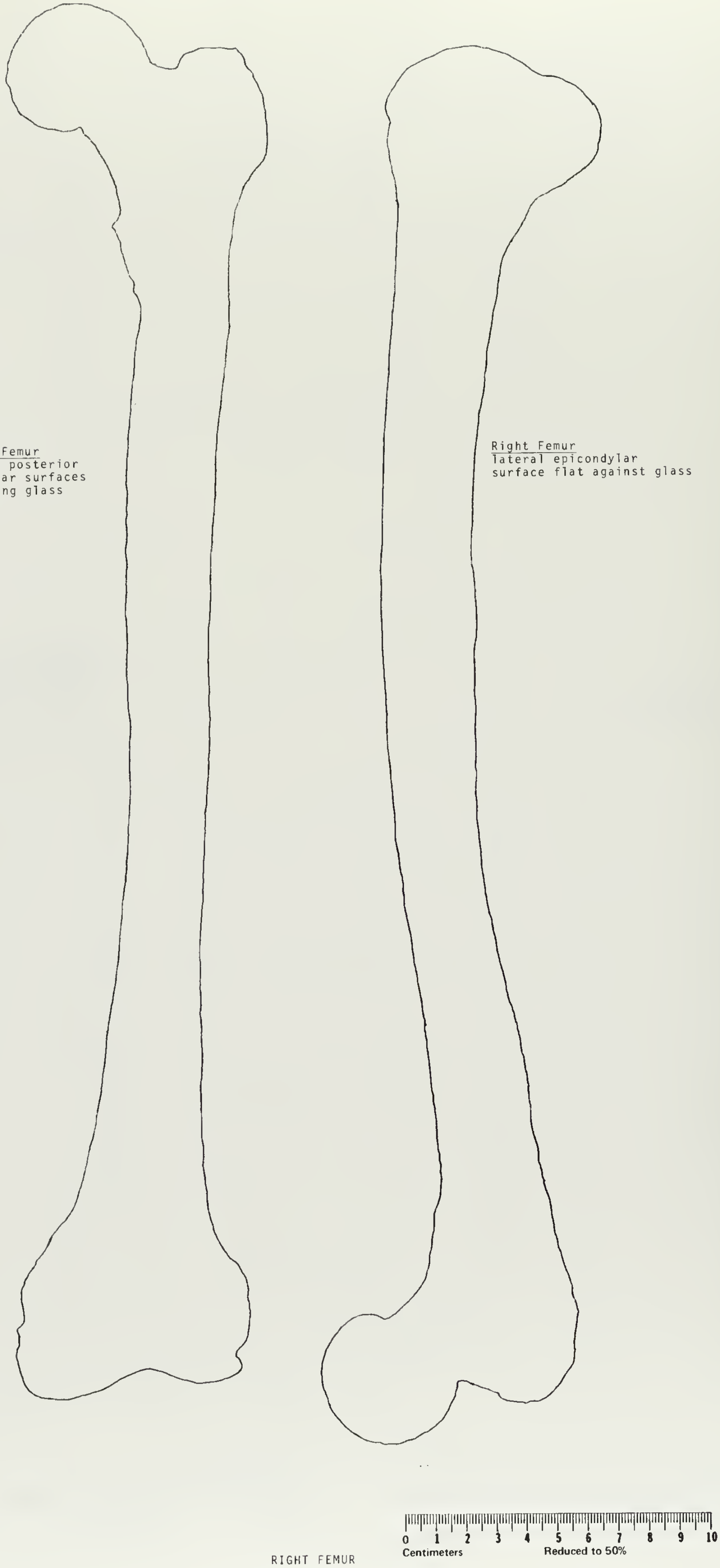


Anterior surface to glass

SACRUM


Left Femur
posteror distal
condylar
surfaces against
glass
Left Femur
lateral epicondylar
surface flat against
glass
0 1 2 3 4 5 6 7 8 9 10
Centimeters
Reduced to 50%

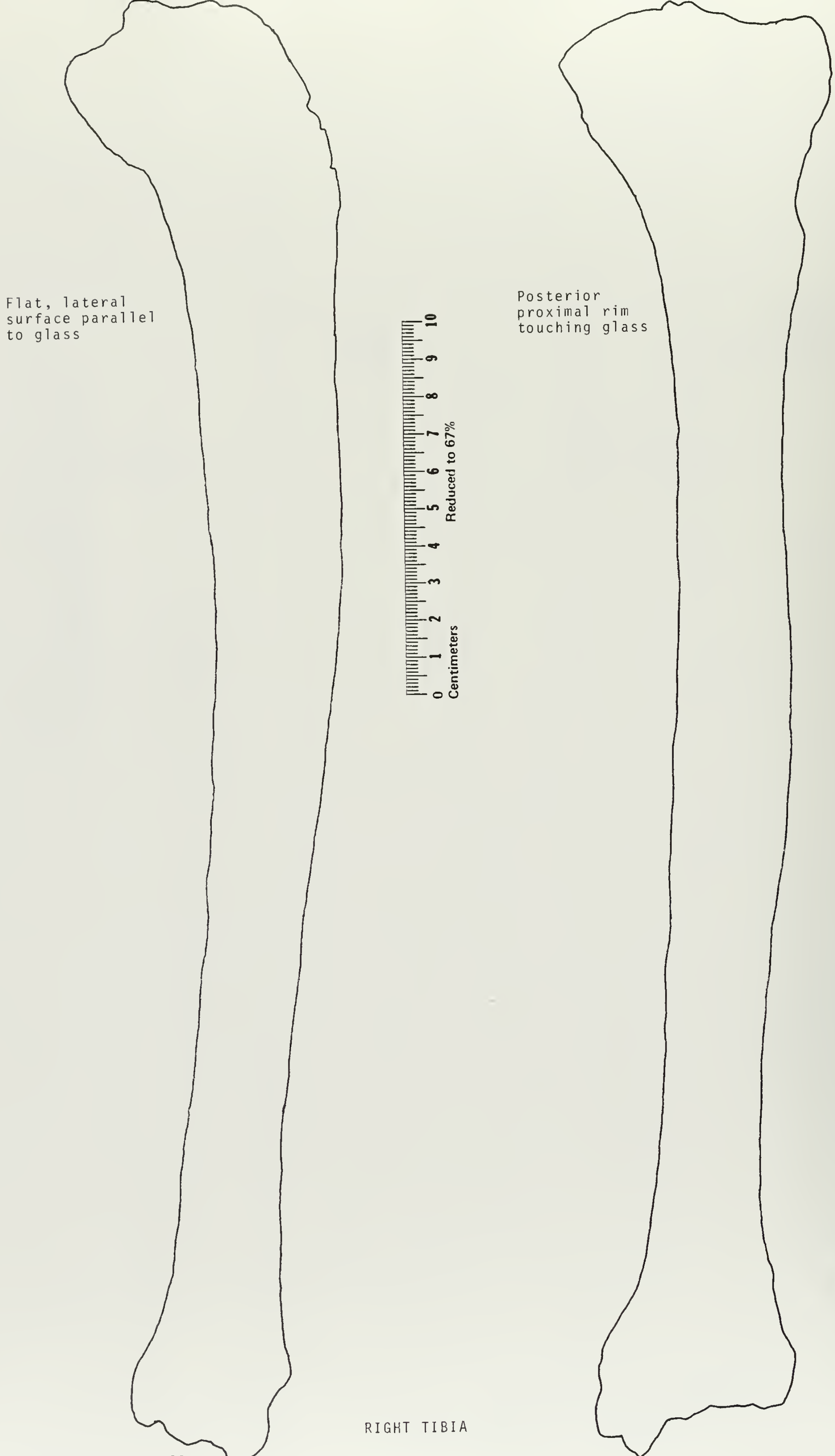
LEFT FEMUR


Right Femur
distal posterior
condylar surfaces
touching glass
Right Femur
lateral epicondylar
surface flat against glass
0 1 2 3 4 5 6 7 8 9 10
Centimeters
Reduced to 50%

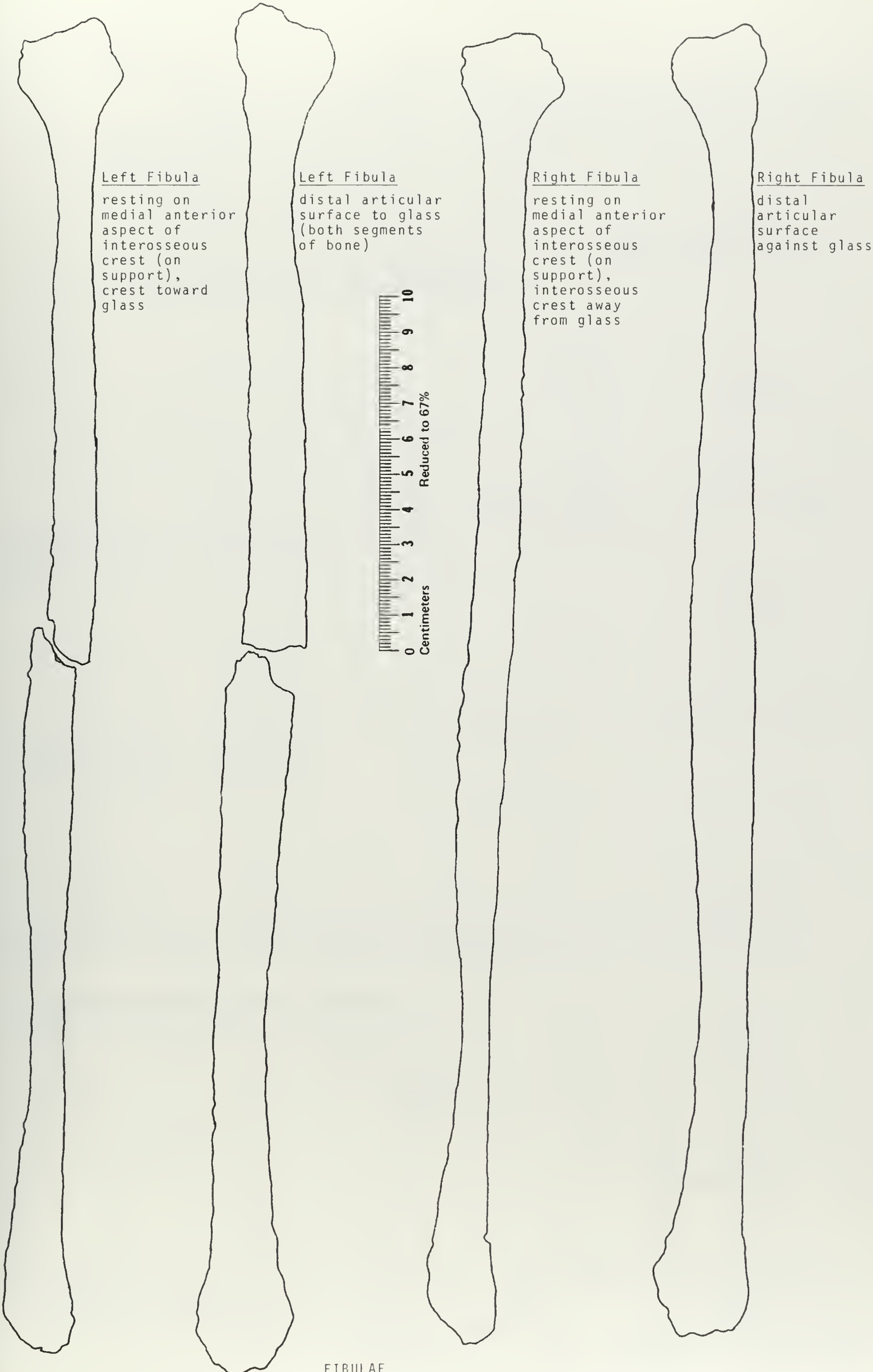
RIGHT FEMUR


Posterior
proximal
condylar rim
touching glass
Flat, lateral
surface
parallel
to glass
0 1 2 3 4 5 6 7 8 9 10
Centimeters
Reduced to 67%

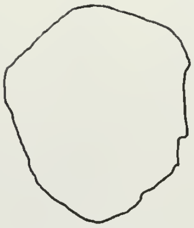
LEFT TIBIA


Flat, lateral surface parallel to glass
Posterior proximal rim touching glass
0 1 2 3 4 5 6 7 8 9 10
Centimeters
Reduced to 67%

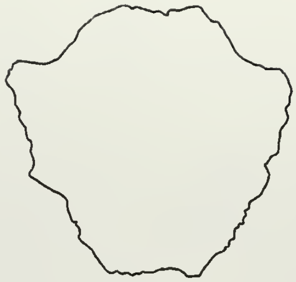
RIGHT TIBIA


Left Fibula
resting on medial anterior aspect of interosseous crest (on support), crest toward glass
Left Fibula
distal articular surface to glass (both segments of bone)
Right Fibula
resting on medial anterior aspect of interosseous crest (on support), interosseous crest away from glass
Right Fibula
distal articular surface against glass
0 1 2 3 4 5 6 7 8 9 10
Centimeters
Reduced to 67%

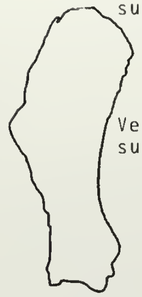
FIBULAE



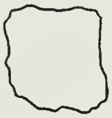
Left Patella; lateral posterior surface against glass



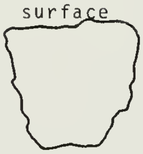
Manubrium; anterior surface against glass



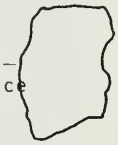
Manubrium; right surface against glass



Left 2nd Cuneiform; lateral surface to glass



Left 3rd Cuneiform; lateral articular surface to glass



Left 3rd Cuneiform; dorsal to glass

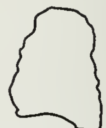
Left Lunate; triquetral articular surface to glass

Left Triquetral; distal articular surface to glass

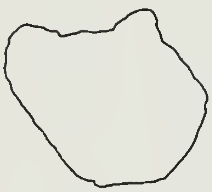
Left 2nd Cuneiform; navicular side to glass

Left Cuboid; dorsal surface to glass

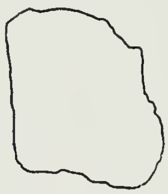
Left Capitate medial surface to glass; posterior to left



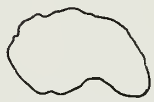
Right Capitate medial surface to glass; posterior to right



Left Navicular posteror surface to glass

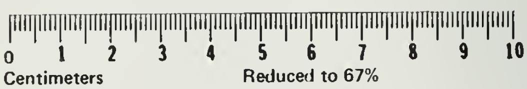


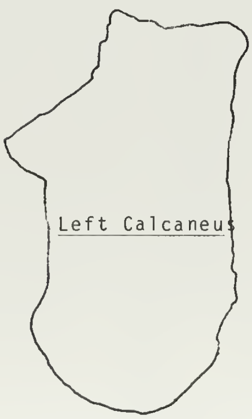
Left 1st Cuneiform lateral surface to glass



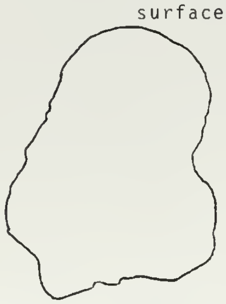
Right Navicular; distal surface to glass

Left Navicular; distal surface to glass

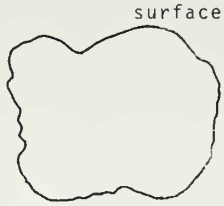




sustentaculum tali and heel on glass such that calcaneus doesn't rock back and forth



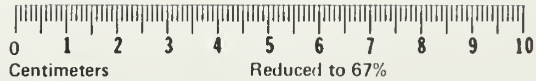
Left Talus; calcaneus articular surface to glass



Left Talus; navicular articular surface to glass

2nd Left Metacarpal
lateral side to glass

2nd Left Metacarpal
dorsal surface to glass



1st Right Metacarpal
lateral surface to glass

1st Right Metacarpal
dorsal surface to glass

4th Left Metacarpal,
lateral surface to glass

4th Left Metacarpal
dorsal surface to glass

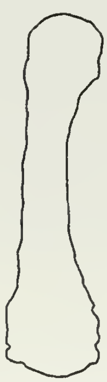
2nd Left Metatarsal
lateral surface to glass

2nd Left Metatarsal
dorsal surface to glass

1st Left Metatarsal
lateral proximal surface to glass

1st Left Metatarsal
dorsal surface to glass

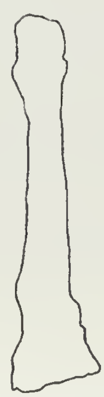
4th Left Metatarsal
lateral surface to glass



4th Left Metatarsal, medial distal surface flat to glass

4th Left Metatarsal, dorsal surface to glass

3rd Left Metatarsal
lateral surface to glass



3rd Left Metatarsal
dorsal surface to glass

METACARPALS AND METATARSALS

CRANIAL MEASUREMENTS

(In centimeters, unless otherwise noted)

5.02	Alveolar Length, External
n.a.	Alveolus Radius (at M1)
49.1	Basion Angle, nasion to bregma (in degrees)
40.4	Basion Angle, nasion to prosthion (in degrees)
15.3	Basion to Bregma Height
10.25	Basion to Prosthion Length
10.5	Basion to Nasion Length
n.a.	Basion Radius
11.84	Biasterionic Breadth
12.79	Biauricular Breadth
10.02	Bifrontal Breadth
11.33	Bijugal Breadth (approximate)
10.56	Bimaxillary Breadth
10.25	Biorbital Breadth
n.a.	Bistephanic Angle (in degrees)
13.2	Bistephanic Breadth
13.9	Bizygomatic Breadth
10.5	Bregma-Lambda Chord
2.47	Bregma-Lambda Subtense
n.a.	Bregma Radius
5.04	Bregma-Subtense Fraction
2.60	Cheek Height
n.a.	Cranial Base Angle (in degrees)
15.1	Cranial Breadth Maximum
7.75	Cranial Breadth Minimum
155.77	Dacryal Angle (in degrees)
n.a.	Dacryon Radius
8.5	Dacryon Subtense (approximate, as point of coordinate arm not sharp enough to rest directly on dacryon)
n.a.	Ectoconchion Radius
3.69	Foramen Magnum Length
131.75	Frontal Angle (in degrees)
13.2	Frontal Breadth, Maximum
9.3	Frontal Breadth, Minimum (difficult to define, as fronto-sphenoid suture obliterated)
n.a.	Frontomalare Radius
17.1	Glabello-Occipital Length
0.3	Glabella Projection
2.42	Interorbital Breadth
10.3	Lambda-Opisthion Chord
2.59	Lambda-Opisthion Subtense, estimated because of crack in occipital
n.a.	Lambda Radius
5.02	Lambda-Subtense Fraction, estimated because of crack in occipital

3.68	Malar Length Inferior
5.43	Malar Length Maximum
0.4	Malar Subtense
2.64	Mastoid Height Left
2.41	Mastoid Height Right
1.05	Mastoid Width, Left
1.34	Mastoid Width, Right
2.66	Nasal Breadth
5.18	Nasal Height
150.69	Nasio-Frontal Angle (in degrees)
1.31	Nasio-Frontal Subtense
87.6	Nasion Angle, basion to bregma (in degrees)
67.92	Nasion Angle, basion to prosthion (in degrees)
11.57	Nasion-Bregma Chord
2.58	Nasion-Bregma Subtense
7.17	Nasion Prosthion Height
n.a.	Nasion Radius
5.38	Nasion Subtense Fraction
16.6	Nasio-Occipital Length
96.49	Naso-Dacryal Angle (in degrees)
1.08	Naso-Dacryal Subtense
126.57	Occipital Angle (in degrees)
n.a.	Opisthion Radius
4.05	Orbital Breadth, Left
3.40	Orbital Height, Left
6.6	Palate Breadth, External
129.55	Parietal Angle, (in degrees)
71.7	Prosthion Angle, nasion to basion (in degrees)
n.a.	Prosthion Radius
143.48	Simotic Angle (in degrees)
0.97	Simotic Chord
0.32	Simotic Subtense
n.a.	Stephanic Subtense
n.a.	Subspinale Radius
0.72	Supraorbital Projection
n.a.	Vertex Radius
n.a.	Zygomaxillare Radius
134.39	Zygomaxillary Angle (in degrees)
2.22	Zygomaxillary Subtense (called Bimaxillary Subtense in Howells, 1973 (see discussion of measurements)
n.a.	Zygoorbitale Radius

DENTAL MEASUREMENTS, MAXILLA

L: n.a.	R: n.a.	Mesio-distal diameter, 3rd Molar (left missing, right broken)
L: n.a.	R: n.a.	Bucco-lingual diameter, 3rd Molar
L: n.a.	R: n.a.	Crown Index (Bucco-lingual/Mesio-distal)
L: n.a.	R: 0.95	Mesio-distal diameter, 2nd Molar (left missing)
L: n.a.	R: 1.15	Bucco-lingual diameter, 2nd Molar
L: n.a.	R:121.1	Crown Index, 2nd Molar
L: 1.02	R: 1.09	Mesio-distal diameter, 1st Molar
L: 1.20	R: 1.15	Bucco-lingual diameter, 1st Molar
L:117.6	R:105.5	Crown Index, 1st Molar
L: 0.61	R: 0.64	Mesio-distal diameter, 2nd Premolar
L: 0.85	R: 0.89	Bucco-lingual diameter, 2nd Premolar
L:139.3	R:139.1	Crown Index, 2nd Premolar
L: n.a.	R: 0.68	Mesio-distal diameter, 1st Premolar left broken)
L: n.a.	R: 0.93	Bucco-lingual diameter, 1st Premolar
L: n.a.	R:136.8	Crown Index, 1st Premolar
L: 0.85	R: 0.87	Mesio-distal diameter, Canine
L: 0.86	R: 0.82	Bucco-lingual diameter, Canine
L:101.2	R:106.1	Crown Index, Canine

Maxillary Incisors Broken

MANDIBULAR MEASUREMENTS

L: 3.3	R: 3.35	Height of the Mandibular Body
L: 1.45	R: 1.45	Breadth of Mandibular Body
L: 3.8	R: 3.7	Minimum Ramus Breadth
L: 7.4	R: 7.0	Maximum Ramus Height
10.6		Bigonial Width
11.85		Bicondylar Breadth
3.45		Chin Height

DENTAL MEASUREMENTS, MANDIBLE

L: 1.22	R: 1.17	Mesio-distal diameter, 3rd Molar
L: 1.12	R: 1.07	Bucco-lingual diameter, 3rd Molar
L: 91.8	R: 91.4	Crown Index, 3rd Molar
L: 1.10	R: 1.08	Mesio-distal diameter, 2nd Molar
L: 1.04	R: 1.06	Bucco-lingual diameter, 2nd Molar
L: 94.5	R: 98.1	Crown Index, 2nd Molar
L: 1.16	R: 1.17	Mesio-distal diameter, 1st Molar
L: 1.11	R: 1.13	Bucco-lingual diameter, 1st Molar
L: 95.7	R: 96.6	Crown Index, 1st Molar
L: 0.69	R: 0.62	Mesio-distal diameter, 2nd Premolar
L: 0.80	R: 0.79	Bucco-lingual diameter, 2nd Premolar
L:115.9	R:127.4	Crown Index, 2nd Premolar
L: n.a.	R: 0.67	Mesio-distal diameter, 1st Premolar (left broken)
L: n.a.	R: 0.82	Bucco-lingual diameter, 1st Premolar
L: n.a.	R:122.4	Crown Index, 1st Premolar

Mandibular Canines are absent, Incisors all broken

POST-CRANIAL MEASUREMENTS

Humerus

L: n.a.	R: 32.5	Maximum Length
L: 4.97	R: 5.03	Breadth of Upper Epiphysis
L: 2.14	R: 2.24	Maximum Diameter at Midshaft
L: 1.63	R: 1.63	Minimum Diameter at Midshaft
L: 1.98	R: 2.14	Maximum Diameter of Shaft
L: 1.57	R: 1.53	Minimum Diameter of Shaft
L: 4.74	R: 4.76	Maximum Diameter of Head (articular surface)
L: 4.25	R: 4.41	Transverse Diameter of Head (articular surf.)
L: 4.71	R: 4.72	Vertical Diameter of Head (articular surface)
L: 6.24	R: 6.23	Biepicondylar Breadth
L: 4.33	R: 4.36	Width of Distal Articular Surface
L: 6.0	R: 6.2	Least Circumference of Shaft
L: n.a.	R: 6.5	Circumference at Midshaft
L: Absent	R: Absent	Supra-Condyloid Fossa

Radius

L: 26.9	R: n.a.	Maximum Length
L: 2.15	R: 2.21	Maximum Diameter of Head
L: 4.1	R: n.a.	Maximum Circumference of Shaft
L: 3.8	R: n.a.	Circumference at Midshaft
L: 3.00	R: n.a.	Distal Medio-Lateral Diameter
L: 0.92	R: n.a.	Minimum Diameter of Shaft
L: 1.45	R: n.a.	Maximum Diameter of Shaft
L: 1.01	R: n.a.	Minimum Diameter at Midshaft
L: 1.31	R: n.a.	Maximum Diameter at Midshaft

Ulna

L: 28.3	R: 28.7	Maximum Length (approx.: styloid processes broken)
L: 2.67	R: 2.69	Maximum Breadth of Olecranon Process
L: 2.23	R: 2.23	Minimum Breadth of Entire Olecranon Process
L: 1.57	R: 1.46	Minimum Breadth of Articular Surface of Olecranon Process
L: 3.58	R: 3.61	Maximum Width of Olecranon Process
L: 3.27	R: 3.49	Olecranon Process to Radial Notch Length
L: 2.35	R: 2.40	Olecranon Process to Coronoid Process Length
L: 25.5	R: 25.9	Physiological Length
L: 3.3	R: 3.4	Least Circumference of Shaft
L: 4.4	R: 4.4	Circumference of Midshaft

Femur

L: 45.5	R: 45.1	Maximum Length
L: 45.1	R: 44.7	Oblique Length (Bicondylar Length)
L: 43.6	R: 43.2	Trochanteric Length
L: 2.48	R: 2.64	Subtrochanteric Anterior-Posterior Diameter
L: 3.38	R: 3.55	Subtrochanteric Medial-Lateral Diameter
L: 3.07	R: 3.14	Anterior-Posterior Diameter of Midshaft
L: 2.57	R: 2.45	Medio-Lateral Diameter of Midshaft
L: 8.57	R: 8.9	Circumference of Midshaft
L: 4.51	R: 4.47	Vertical Head Diameter
L: 4.46	R: 4.46	Horizontal Diameter of Head
L: 4.54	R: 4.51	Maximum Diameter of Head
L: 6.50	R: 6.21	Anterior-Posterior Diameter of Lateral Condyle
L: n.a.	R: n.a.	Anterior-Posterior Diameter of Medial Condyle
L: 7.99	R: n.a.	Epicondylar Breadth
L: 4.48	R: n.a.	Bicondylar Breadth
L: 2.96	R: 3.25	Vertical Diameter of Neck
L: 6.4	R: 5.9	Capito-Collar Length
L: 53.	R: 58.	Neck Angle (medio-inferior angle, in degrees)
L: 83.	R: 83.	Femoral Condyle Angle (medial angle, in degrees)

Tibia

L: 38.5	R: 38.4	Maximum Length
L: n.a.	R: n.a.	Maximum Breadth of Proximal Epiphysis
L: 5.13	R: 5.10	Maximum Breadth of Distal Epiphysis
L: 3.70	R: 3.72	Anterior-Posterior Diameter at Nutrient Foramen
L: 2.35	R: 2.25	Medio-Lateral Diameter at Nutrient Foramen
L: 11.65	R: n.a.	Position of Nutrient Foramen
L: 9.2	R: 9.1	Circumference at Midshaft

Fibula

L: n.a.	R: n.a.	Maximum Length
L: 2.05	R: 2.04	Maximum Diameter at Midshaft
L: 5.3	R: 5.3	Circumference at Midshaft

Clavicle

L: 16.3	R: 15.6	Maximum Length
L: 1.35	R: 1.14	Sagittal Diameter at Midshaft
L: 0.96	R: 0.97	Vertical Diameter at Midshaft
L: 3.6	R: 3.8	Circumference at Midshaft

Scapula

L: 17.4	R: n.a.	Maximum Length
L: 10.72	R: 9.89	Maximum Breadth
L: 14.12	R: 13.36	Length of Spine
L: 5.54	R: n.a.	Length of Supra-Spinous Line
L: 13.20	R: 13.84	Length of Infra-Spinous Line
L: 2.86	R: 2.71	Glenoid Cavity Breadth
L: 3.54	R: n.a.	Glenoid Cavity Height
L: 15.31	R: 15.32	Mid-Glenoid to Inferior Angle Length
L: 58.89	R: 62.43	Border Angle
L: 79.85	R: 78.88	Vertebral Border Angle
L: 43.46	R: 39.31	Inferior Angle
L: 34.33	R: n.a.	Superior Angle
L: 13.69	R: n.a.	Caudal Angle
L: 48.02	R: n.a.	Medial Angle
L: Deep	R: Deep	Suprascapular notch

Patella

L: 4.25	R: n.a.	Maximum Cranio-Caudal Diameter
L: n.a.	R: n.a.	Maximum Medio-Lateral Diameter

Sternum

5.20	Length of Manubrium (from jugular notch, unfused with rest of skeleton in this skeleton)
n.a.	Length of Body
n.a.	Length of Xiphoid
5.70	Greatest Width of Manubrium

Innominate

Right innominate greatly cracked, both innominata too broken for reliable results of most measurements

L: 21.7	R: n.a.	Maximum height
L: 16.2	R: n.a.	Maximum Width
L: n.a.	R: n.a.	Maximum Ischio-Pubic Diameter
L: 6.08	R: 5.65	Minimum Ilium Width
L: n.a.	R: 3.40	Height of Pubic Symphysis
L: n.a.	R: n.a.	Pubic Symphysis to Anterior Superior Spine
L: n.a.	R: n.a.	Pubic symphysis to Anterior Inferior Spine
L: n.a.	R: n.a.	Pubic Symphysis to Auricular Surface
L: n.a.	R: n.a.	Pubic Symphysis to Mid-Sciatic Notch
L: n.a.	R: n.a.	Pubic Symphysis to Terminal Tip of Auricular Facet
L: n.a.	R: n.a.	Pubic Symphysis to Posterior Superior Spine
L: n.a.	R: n.a.	Pubic Symphysis to Nearest Acetabular Border
L: n.a.	R: n.a.	Pubic Symphysis to Inferior Ischial Tuberosity
L: n.a.	R: n.a.	Pubic Length
L: 8.25	R: 8.16	Ischial Length
L: 9.45	R: ~9.38	Acetabulum to Posterior Superior Spine
L: 8.25	R: 8.00	Acetabulum to Posterior Inferior Spine
L: ~9.45	R: n.a.	Acetabulum to Anterior Superior Spine
L: ~5.42	R: 5.45	Acetabulum to Anterior Inferior Spine
L: n.a.	R: n.a.	Maximum Diameter of Acetabulum
L: 5.68	R: 5.87	Maximum Length of Auricular Surface
L: 2.44	R: 2.48	Auricular Surface to Mid-Sciatic Notch
L: n.a.	R: 6.60	Auricular Surface to Acetabular Border
L: 9.62	R: n.a.	Auricular Surface to Anterior Superior Spine
L: 6.86	R: 6.61	Auricular Surface to Anterior Inferior Spine
L: 6.50	R: n.a.	Auricular Surface to Posterior Superior Spine
L: 5.30	R: n.a.	Auricular Surface to Terminal Tip of Auricular Surface
L: ~11.65	R: n.a.	Inferior Iliac Breadth
L: 15.9	R: n.a.	Superior Iliac Breadth
L: n.a.	R: n.a.	Middle Width of Pubis
L: n.a.	R: n.a.	Height of Obturator Foramen
L: n.a.	R: n.a.	Width of Obturator Foramen
L: 5.62	R: 6.09	Length of Ischial Tuberosity
L: 2.83	R: 2.69	Breadth of Ischial Tuberosity
L: n.a.	R: n.a.	Sciatic Notch Subtense
L: n.a.	R: n.a.	Sciatic Notch Fraction
L: 4.11	R: n.a.	Anterior Border Breadth (Anterior Border Chord)
L: 1.30	R: n.a.	Anterior Border Subtense
L: 2.54	R: n.a.	Anterior Border Fraction

Articulated Pelvis Measurements

None available, as pubic bones missing, and articulation not possible

Sacrum

10.79	Mid-Ventral Straight Length
1.55	Sacral Subtense
6.69	Sacral Fraction
10.46	Anterior Straight Breadth
5.31	Transverse Diameter of First Sacral Vertebra
3.50	Anteroposterior Diameter of First Sacral Vertebra
2.08	Basal Width

(String stretched across proximal and distal anterior borders for Sacral Subtense and Sacral Fractions)

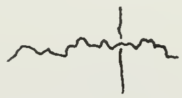
NON-METRIC CRANIAL TRAITS

"A": Absent "P": Present "NA": not available

Alternative terms for the same feature are listed in parantheses, and are explained in description section following.

L: A	R: A	Accessory Infraorbital Foramen
L: P	R: P	Accessory Lesser Palatine Foramen
L: P	R: P	Accessory Mandibular Foramen
L: P	R: A	Accessory Zygo-Facial Foramen
L: A	R: A	Anterior Condylar Canal Double (Hypoglossal Canal Double)
L: P	R: P	Anterior Ethmoid Foramen Extra-Sutural
L: na	R: A	Asterionic Ossicle (areas damaged)
L: A	R: A	Auditory Torus
A		Bregmatic Ossicle (Bregmatic Bone)
L: A	R: A	Canaliculus Innominatus
L: P	R: P	Carotico-Clinoid Foramen
L: A	R: A	Clino-Clinoid Bridge
L: A	R: A	Condylar Facet Double
L: P	R: P	Coronal Ossicle (very small, both sides)
L: A	R: A	Digastric Groove Double
L: A	R: A	Double Mental foramen
L: A	R: A	Epipteric Bones
L: P	R: P	External Frontal Sulcus
L: P	R: P	Foramen of Huschke (Dehiscence)
L: A	R: A	Foramen Ovale Incomplete
L: A	R: A	Foramen Ovale Open
L: A	R: A	Foramen Spinosum Open
L: P	R: P	Foramen of Vesalius
L: A	R: A	Frontal Foramen (would be present on right, but opens into orbit)
L: P	R: P	Frontal Notch/ Foramen (are actual foramina)
L: na	R: na	Fronto-Temporal Articulation {sutures obliterated}
L: P	R: P	Highest Nuchal Line
L: S	R: S	Infra-Orbital Foramen (both single foramen)
L: P	R: P	Lacrimal Foramen
L: P	R: P	Lambdoid Ossicle
L: A	R: A	Mandibular Foramen Double
L: P	R: P	Mandibular Torus
L: na	R: P	Mastoid Foramen (left side damaged)
L: na	R: P	Mastoid Foramen Extra-Sutural (left side damaged)
L: P	R: P	Maxillary Torus (Malar Tubercle)
A		Metopic Suture
L: P	R: P	Mylo-Hyoid Bridge
A		Os Inca
L: A	R: A	Os Japonicum
A		Ossicle at Lambda

L: na R: P	Ossicle in Mastoid Suture (Riolan´s Ossicle)
L: nv R: nv	Oval Window (visible, not visible)
	Palatal Suture shape



P	Palatine Torus
L: na R: P	Para-Mastoid Process
L: A R: P	Parietal Foramen
L: A R: A	Parietal Notch Bone
L: A R: P	Petrosquamous Suture (just series of depressions on left, more distinct fissure on right)
P	Pharyngeal Fossa
L: P R: P	Posterior Condylar Canal (patent)
L: P R: P	Posterior Ethmoid Foramen
L: A R: A	Posterior Malar Foramen
L: P R: P	Precondylar Tubercle
L: na R: na	Pterion Form {sutures obliterated, so not available
L: A R: A	Pterygo-Alar Foramen of Hyrtl
P	Sagittal Ossicles (present, incompletely enclosed, suture obliterated)
L: P R: A	Spine of Henle
L: P R: P	Stylomastoid Foramen
A	Superior Sagittal Sinus Turns Left {turns right}
L: P R: A	Supraorbital Foramen
L: A R: P	Supraorbital Notch
L: A R: A	Supratrochlear Spur
L: P R: P	Sutures into the Infraorbital Foramen (only anterior aspect patent)
L: A R: A	Temporo-squamous Ossicles
L: P R: P	Zygomatico-facial Foramen
L: P R: P	Zygo-maxillary Tuberosity
L: P R: P	Zygo-Root Foramen

SOIL AND BONE ANALYSIS

by A.R. Harding, Ph.D.

INTRODUCTION

The objective of this report is to describe the elemental characterization of a bone and soil sample of anthropological interest. The method employed was energy dispersive x-ray flourescence spectrometry (EDXRF). This non-destructive analytical technique relies on an X-ray tube excitation source and detection of subsequent x-ray emission from the atomic constituents of the sample. The EDXRF spectrometer is capable of analyzing x-ray emission from atomic numbers 11 and above in a variety of sample types.

EXPERIMENTAL

The EDXRF spectrometer used was a Tracor Xray TX5000 which uses a 500 kV, 0.35 mA Rh anode X-ray tube and power supply for sample excitation. The X-ray detector is a Si (Li) type X-ray sensitive diode (155 eV full width at half peak maximum- Mn K alpha X-ray). The X-ray analyzer is an IBM PC/AT which executes copyrighted software for data acquisition and analysis.

A piece of bone was cut from the sample and washed with distilled deionized water. The piece was shattered with a hammer then subjected to grinding in a tungsten carbide shatterbox grinder (Spex Industries) for 20 minutes. An aliquot of the resulting powder (approximately three grams) was pressed into a pellet in an Al reinforcing cup (Spex Industries) under approximately 3 tons pressure. The sample was then presented to the spectrometer in this form.

Size fractionation was performed on the soil sample and the fraction passing 200 mesh was pressed into an aluminum reinforcing cup (Spex Industries) at approximately 3 tons and thereby presented to the spectrometer.

INSTRUMENT CALIBRATION

Three geological samples (Western Phosphate Rock 694 and Cement Standard 634 [National Bureau of Standards] and BR [French Geochemical Society]) were analyzed for the following elements: Al, Si, P, S, Ca, K, Mn, Fe, Zn, and Sr. The remainder of the sample is assumed to consist of carbon and oxygen (CO_2). Two sets of X-ray excitation conditions were used and are listed on the attached printout. The first set acquires Al through S data and the second set acquires Ca through Sr data. Using a fundamental parameters data treatment program, the sensitivity for each element in the standards is computed. The sensitivity value can be applied to the measured atomic emission intensities obtained for the bone and soil samples.

RESULTS

The attached printout designates the elemental consituents of the bone and soil samples as weight percent elemental oxide. In some cases it is convenient to express results in weight percent elemental form. Table 1 lists the weight percent value for each element.

ELEMENT	BONE SAMPLE WT. %	SOIL SAMPLE WT. %
Al	.056	6.571
Si	0	25.243
P	15.009	0
S	.018	.002
Ca	35.241	2.593
K	0	2.020
Fe	.025	1.765
Sr	.052	.013
Zn	.010	.005
Mn	.006	.039

Table 1. Bone and soil sample results expressed in terms of elemental weight percent

CONCLUSIONS

The preceding bone and soil sample results do not have an independent analysis with which to compare. It has been shown, however, that using a fundamental parameters data treatment, accuracy can be expected to be within ± percent relative.

EDXRF ANALYSIS

PROCEDURE: LOW
FILTER USED: NO FILTER
ANALYSIS METHOD: FUN. PARAMS

TUBE VOLTAGE: 7 KV
TUBE CURRENT: 0.10 MA
LIVETIME: 200 SEC

TIME: 5:02 pm

DATE: 11/7/86

EDXRF ANALYSIS

PROCEDURE: HIGH
FILTER USED: THIN
ANALYSIS METHOD: FUN. PARAMS.

TUBE VOLATAGE: 30 KV
TUBE CURRENT: 0.09 MA
LIVETIME: 200 SEC

TIME: 5:02 pm

DATE: 11/7/86

EDXRF ANALYSIS

PROCEDURE: 2+3
FILTER USED: THIN
ANALYSIS METHOD: FUN. PARAMS.

TUBE VOLTAGE: 30 KV
TUBE CURRENT: 0.02 MA
LIVETIME: 100 SEC

TIME: 5:03 pm

DATE: 11/7/86

SAMPLE	ELEMENT	CONCENTRATION	NORMALIZED
BONE	AL2O3	0.056	0.056%
	SIO2	0.000	0.000%
	P2O5	34.425	34.425%
	S	0.018	0.018%
	CAO	49.288	49.288%
	K2O	0.000	0.000%
	FE2O3	0.036	0.036%
	SRO	0.068	0.068%
	ZNO	0.013	0.013%
	MNO	0.008	0.008%
	C O2	16.088	16.088% DIFF
SOIL	AL2O3	12.417	12.417%
	SIO2	54.000	54.000%
	P2O5	0.000	0.000%
	S	0.002	0.002%
	CAO	3.628	3.628%
	K2O	2.433	2.433%
	FE2O3	2.523	2.523%
	SRO	0.015	0.015%
	ZNO	0.006	0.006%
	MNO	0.051	0.051%
	C O2	24.925	24.925% DIFF

EDXRF ANALYSIS

PROCEDURE : LOW
FILTER USED : NO FILTER
ANALYSIS METHOD : FUN. PARAMS.

TUBE VOLTAGE : 7 KV
TUBE CURRENT : 0.09 MA
LIVETIME : 200 SEC

TIME : 7:09 pm

DATE : 11/20/86

EDXRF ANALYSIS

PROCEDURE : HIGH
FILTER USED : THIN
ANALYSIS METHOD : FUN. PARAMS.

TUBE VOLTAGE : 30 KV
TUBE CURRENT : 0.09 MA
LIVETIME : 300 SEC

TIME : 7:10 pm

DATE : 11/20/86

EDXRF ANALYSIS

PROCEDURE : 2+3
FILTER USED : NO FILTER
ANALYSIS METHOD : FUN. PARAMS.

TUBE VOLTAGE : 7 KV
TUBE CURRENT : 0.10 MA
LIVETIME : 200 SEC

TIME : 7:10 pm

DATE : 11/20/86

** STANDARD WEST PHOS **

O -	45.230
AL -	0.953
SI -	5.235
P -	13.180
S -	0.010
CA -	31.161
K -	0.423
FE -	0.553
SR -	0.000
ZN -	0.000
MN -	0.015
C -	3.240
TOTAL	100.000

** STANDARD BR **

O -	49.656
AL -	5.425
SI -	17.945
P -	0.458
S -	0.100
CA -	9.913
K -	1.171
FE -	9.023
SR -	0.127
ZN -	0.016
MN -	0.310
C -	5.857
TOTAL	100.000

```
** STANDARD 6[illegible]4 **
O  -   37.483
AL -    2.757
SI -    9.690
P  -    0.000
S  -    0.880
CA -   44.726
K  -    0.349
FE -    1.986
SR -    0.000
ZN -    0.000
MN -    0.194
C  -    1.935
TAL  100.000
```

```
COUNT RATE FOR PURE ELEMENT **
      0
   3703
   7914
  10183
  37467
   8941
   9240
      0
      0
      0
      0
      0
```

CONCENTRATIONS

ANDARD	O	AL	SI	P	S	CA	K	FE
ST PHOS	45.230	0.953	5.235	13.180	0.010	31.161	0.423	0.553
	49.656	5.425	17.945	0.458	0.100	9.913	1.171	9.023
4	37.483	2.757	9.690	0.000	0.880	44.726	0.349	1.986

ANDARD	SR	ZN	MN	C
ST PHOS	0.000	0.000	0.015	3.240
	0.127	0.016	0.310	5.857
4	0.000	0.000	0.194	1.935

INTENSITIES

NDARD	O	AL	SI	P	S	CA	K	FE
T PHOS	0.000	0.685	5.372	15.084	0.013	48.577	0.704	0.000
	0.000	3.693	15.770	0.383	0.117	18.877	1.994	0.000
	0.000	1.884	9.195	0.000	1.259	65.261	0.620	0.000

NDARD	SR	ZN	MN	C
T PHOS	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000

CONCENTRATIONS

STANDARD	O	AL	SI	P	S	CA	K	FE
0	44.123	3.045	10.957	4.546	0.330	28.600	0.648	3.854
1	48.535	2.805	10.092	4.187	0.304	26.342	0.596	3.550
2	43.668	4.045	10.844	4.499	0.327	28.305	0.641	3.814
3	43.580	3.007	12.052	4.490	0.326	28.248	0.640	3.806
4	43.661	3.013	10.842	5.546	0.327	28.300	0.641	3.814
5	43.680	3.014	10.847	4.500	1.330	28.313	0.641	3.815
6	42.356	2.923	10.518	4.364	0.317	31.460	0.622	3.700
7	43.679	3.014	10.846	4.500	0.327	28.312	1.648	3.815
8	43.664	3.013	10.843	4.499	0.327	28.302	0.641	4.854
9	43.682	3.014	10.847	4.501	0.327	28.314	0.641	3.815
10	43.682	3.015	10.847	4.501	0.327	28.314	0.641	3.815
11	43.681	3.014	10.847	4.501	0.327	28.313	0.641	3.815
12	43.665	3.013	10.843	4.499	0.327	28.303	0.641	3.814

STANDARD	SR	ZN	MN	C
0	0.042	0.005	0.173	3.677
1	0.039	0.005	0.159	3.387
2	0.042	0.005	0.171	3.639
3	0.042	0.005	0.171	3.632
4	0.042	0.005	0.171	3.639
5	0.042	0.005	0.171	3.640
6	0.041	0.005	0.166	3.530
7	0.042	0.005	0.171	3.640
8 -	0.042	0.005	0.171	3.639
9	1.042	0.005	0.171	3.640
10	0.042	1.005	0.171	3.640
11	0.042	0.005	1.173	3.640
12	0.042	0.005	0.171	4.677

INTENSITIES

STANDARD	O	AL	SI	P	S	CA	K	FE
0	0.000	2.111	10.371	4.474	0.420	46.284	1.102	0.000
1	0.000	1.950	9.666	4.237	0.400	44.992	1.060	0.000
2	0.000	2.811	10.084	4.374	0.411	45.650	1.082	0.000
3	0.000	2.090	11.405	4.332	0.408	45.333	1.072	0.000
4	0.000	2.093	10.269	5.455	0.408	45.362	1.073	0.000
5	0.000	2.091	10.262	4.428	1.687	45.222	1.069	0.000
6	0.000	2.019	9.961	4.333	0.408	49.658	1.058	0.000
7	0.000	2.091	10.281	4.443	0.417	44.780	2.778	0.000
8	0.000	2.064	10.159	4.401	0.414	45.831	1.088	0.000
9	0.000	2.079	10.188	4.308	0.404	45.041	1.063	0.000
10	0.000	2.043	10.071	4.372	0.411	45.644	1.082	0.000
11	0.000	2.071	10.192	4.413	0.415	45.910	1.090	0.000
12	0.000	2.102	10.331	4.461	0.419	46.220	1.100	0.000

STANDARD	SR	ZN	MN	C
0	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000

** ALPHAS **

	O	AL	SI	P	S	CA	K	FE
AL KA	0.396	0.000	0.170	0.201	0.364	0.574	0.338	2.138
SI KA	-0.096	1.915	0.000	0.025	0.126	0.054	-0.075	1.125
P KA	-0.334	1.241	1.688	0.000	0.053	-0.201	-0.289	0.612
S KA	-0.541	0.598	0.947	1.139	0.000	-0.429	-0.480	0.139
CA KA	-0.792	-0.170	0.050	0.194	0.435	0.000	1.044	-0.413
K KA	-0.725	0.059	0.343	0.508	0.814	-0.403	0.000	-0.251

	SR	ZN	MN	C
AL KA	1.220	3.730	1.772	-0.373
SI KA	0.893	2.129	0.853	-0.581
P KA	2.872	1.356	0.394	-0.709
S KA	2.101	0.657	-0.023	-0.809
CA KA	0.690	-0.140	-0.500	-0.911
K KA	1.130	0.086	-0.371	-0.890

** STANDARD WEST PHOS **

O	-	45.235
AL	-	0.953
SI	-	5.235
P	-	13.180
S	-	0.010
CA	-	31.161
K	-	0.423
FE	-	0.553
SR	-	0.000
ZN	-	0.000
MN	-	0.008
C	-	3.242
TOTAL		100.000

** STANDARD BR **

O	-	49.757
AL	-	5.425
SI	-	17.945
P	-	0.458
S	-	0.100
CA	-	9.913
K	-	1.171
FE	-	9.023
SR	-	0.127
ZN	-	0.016
MN	-	0.155
C	-	5.911
TOTAL		100.000

** STANDARD 634 **

O	–	37.483
AL	–	2.757
SI	–	9.690
P	–	0.000
S	–	0.880
CA	–	44.726
K	–	0.349
FE	–	1.986
SR	–	0.000
ZN	–	0.000
MN	–	0.194
C	–	1.935
TOTAL		100.000

** COUNT RATE FOR PURE ELEMENT **

O	0
AL	0
SI	0
P	0
S	0
CA	0
K	0
FE	14429
SR	78060
ZN	29844
MN	14050
C	0

CONCENTRATIONS

STANDARD	O	AL	SI	P	S	CA	K	FE
WEST PHOS	45.235	0.953	5.235	13.180	0.010	31.161	0.423	0.5[illegible]
BR	49.757	5.425	17.945	0.458	0.100	9.913	1.171	9.0[illegible]
634	37.483	2.757	9.690	0.000	0.880	44.726	0.349	1.9[illegible]

STANDARD	SR	ZN	MN	C
WEST PHOS	0.000	0.000	0.008	3.242
BR	0.127	0.016	0.155	5.911
634	0.000	0.000	0.194	1.935

INTENSITIES

STANDARD	O	AL	SI	P	S	CA	K	FE
WEST PHOS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.4[illegible]
BR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.8[illegible]
634	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.1[illegible]

STANDARD	SR	ZN	MN	C
WEST PHOS	0.000	0.000	0.005	0.000
BR	0.577	0.026	0.153	0.000
634	0.000	0.000	0.093	0.000

CONCENTRATIONS

TANDARD	O	AL	SI	P	S	CA	K	FE
	44.158	3.045	10.957	4.546	0.330	28.600	0.648	3.854
	48.574	2.804	10.090	4.187	0.304	26.338	0.596	3.549
	43.703	4.045	10.844	4.499	0.327	28.305	0.641	3.814
	43.615	3.007	12.052	4.490	0.326	28.248	0.640	3.806
	43.696	3.013	10.842	5.546	0.327	28.300	0.641	3.814
	43.715	3.014	10.847	4.500	1.330	28.313	0.641	3.815
	42.389	2.923	10.518	4.364	0.317	31.460	0.622	3.700
	43.714	3.014	10.846	4.500	0.327	28.312	1.648	3.815
	43.699	3.013	10.843	4.499	0.327	28.302	0.641	4.854
	43.716	3.014	10.847	4.501	0.327	28.314	0.641	3.815
0	43.717	3.015	10.847	4.501	0.327	28.314	0.641	3.815
1	43.716	3.014	10.847	4.501	0.327	28.314	0.641	3.815
2	43.700	3.013	10.843	4.499	0.327	28.303	0.641	3.814

TANDARD	SR	ZN	MN	C
	0.042	0.005	0.119	3.696
	0.039	0.005	0.109	3.404
	0.042	0.005	0.118	3.658
	0.042	0.005	0.117	3.651
	0.042	0.005	0.118	3.658
	0.042	0.005	0.118	3.659
	0.041	0.005	0.114	3.548
	0.042	0.005	0.118	3.659
	0.042	0.005	0.118	3.658
	1.042	0.005	0.118	3.659
	0.042	1.005	0.118	3.659
	0.042	0.005	1.119	3.659
	0.042	0.005	0.118	4.696

INTENSITIES

ANDARD	O	AL	SI	P	S	CA	K	FE
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.986
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.945
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.964
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.951
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.951
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.946
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.710
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.924
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.769
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.988
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.998
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.966
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.984

ANDARD	SR	ZN	MN	C
	0.166	0.007	0.075	0.000
	0.165	0.007	0.074	0.000
	0.165	0.007	0.074	0.000
	0.165	0.007	0.074	0.000
	0.165	0.007	0.074	0.000
	0.164	0.007	0.074	0.000
	0.152	0.007	0.068	0.000
	0.163	0.007	0.073	0.000
	0.159	0.007	0.074	0.000
	3.979	0.007	0.075	0.000
	0.156	1.374	0.075	0.000
	0.160	0.007	0.705	0.000
	0.166	0.007	0.075	0.000

** ALPHAS **

	O	AL	SI	P	S	CA	K	FE
FE KA	-0.789	-0.051	0.274	0.446	0.728	2.152	1.711	0.000
SR KA	-0.973	-0.858	-0.811	-0.772	-0.723	-0.445	-0.527	0.098
ZN KA	-0.907	-0.557	-0.415	-0.307	-0.170	0.579	0.359	1.885
MN KA	-0.730	0.190	0.543	0.800	1.154	2.892	2.334	0.017

	SR	ZN	MN	C
FE KA	-1.082	-1.515	-0.125	-0.920
SR KA	0.000	0.606	-0.071	-0.991
ZN KA	-1.173	0.000	1.538	-0.969
MN KA	-1.081	-1.768	0.000	-0.900

** COMBINED FUNDASTD **

CONCENTRATIONS

STANDARD	O	AL	SI	P	S	CA	K	FE
WEST PHOS	45.235	0.953	5.235	13.180	0.010	31.161	0.423	0.5
BR	49.757	5.425	17.945	0.458	0.100	9.913	1.171	9.0
634	37.483	2.757	9.690	0.000	0.880	44.726	0.349	1.9

STANDARD	SR	ZN	MN	C
WEST PHOS	0.000	0.000	0.008	3.242
BR	0.127	0.016	0.155	5.911
634	0.000	0.000	0.194	1.935

INTENSITIES

STANDARD	O	AL	SI	P	S	CA	K	FE
WEST PHOS	0.000	0.685	5.372	15.084	0.013	48.577	0.704	0.4
BR	0.000	3.693	15.770	0.383	0.117	18.877	1.994	10.8
634	0.000	1.884	9.195	0.000	1.259	65.261	0.620	1.1

STANDARD	SR	ZN	MN	C
WEST PHOS	0.000	0.000	0.005	0.000
BR	0.577	0.026	0.153	0.000
634	0.000	0.000	0.093	0.000

** ALPHAS **

	O	AL	SI	P	S	CA	K	FE
AL KA	0.396	0.000	0.170	0.201	0.364	0.574	0.338	2.138
SI KA	-0.096	1.915	0.000	0.025	0.126	0.054	-0.075	1.125
P KA	-0.334	1.241	1.688	0.000	0.053	-0.201	-0.289	0.612
S KA	-0.541	0.598	0.947	1.139	0.000	-0.429	-0.480	0.139
CA KA	-0.792	-0.170	0.050	0.194	0.435	0.000	1.044	-0.413
K KA	-0.725	0.059	0.343	0.508	0.814	-0.403	0.000	-0.251
FE KA	-0.789	-0.051	0.234	0.446	0.728	2.152	1.711	0.000
SR KA	-0.973	-0.858	-0.811	-0.772	-0.723	-0.445	-0.527	0.098
ZN KA	-0.907	-0.557	-0.415	-0.307	-0.170	0.579	0.359	1.885
MN KA	-0.730	0.190	0.543	0.800	1.154	2.892	2.334	0.017

	SR	ZN	MN	C
AL KA	1.220	3.730	1.772	-0.373
SI KA	0.893	2.129	0.853	-0.581
P KA	2.872	1.356	0.394	-0.709
S KA	2.101	0.657	-0.023	-0.809
CA KA	0.690	-0.140	-0.500	-0.911
K KA	1.130	0.086	-0.371	-0.890
FE KA	-1.082	-1.515	-0.125	-0.920
SR KA	0.000	0.606	-0.071	-0.991
ZN KA	-1.173	0.000	1.538	-0.969
MN KA	-1.081	-1.768	0.000	-0.900

EDXRF ANALYSIS

PROCEDURE : LOW
FILTER USED : NO FILTER
ANALYSIS METHOD : FUN. PARAMS.

TUBE VOLTAGE : 7 KV
TUBE CURRENT : 0.09 MA
LIVETIME : 200 SEC

TIME : 7:23 pm

DATE : 11/20/86

EDXRF ANALYSIS

PROCEDURE : HIGH
FILTER USED : THIN
ANALYSIS METHOD : FUN. PARAMS.

TUBE VOLTAGE : 30 KV
TUBE CURRENT : 0.09 MA
LIVETIME : 300 SEC

TIME : 7:23 pm

DATE : 11/20/86

EDXRF ANALYSIS

PROCEDURE : 2+3
FILTER USED : NO FILTER
ANALYSIS METHOD : FUN. PARAMS.

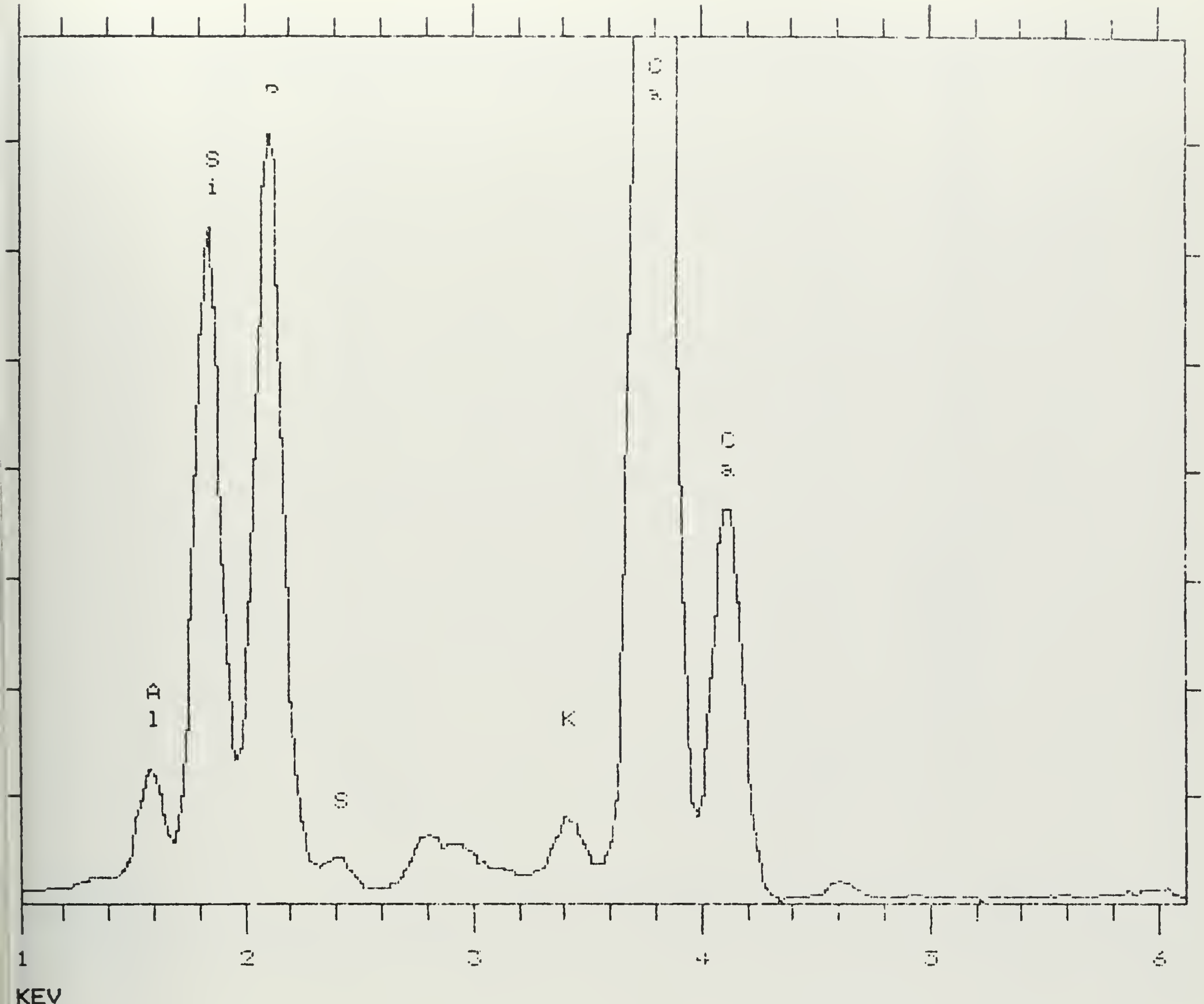
TUBE VOLTAGE : 7 KV
TUBE CURRENT : 0.10 MA
LIVETIME : 200 SEC

TIME : 7:23 pm

DATE : 11/20/86

** STANDARD WEST PHOS **

O -	45.230
AL -	0.953
SI -	5.235
P -	13.180
S -	0.010
CA -	31.161
K -	0.423
FE -	0.553
SR -	0.000
ZN -	0.000
MN -	0.015
C -	3.240
TOTAL	100.000



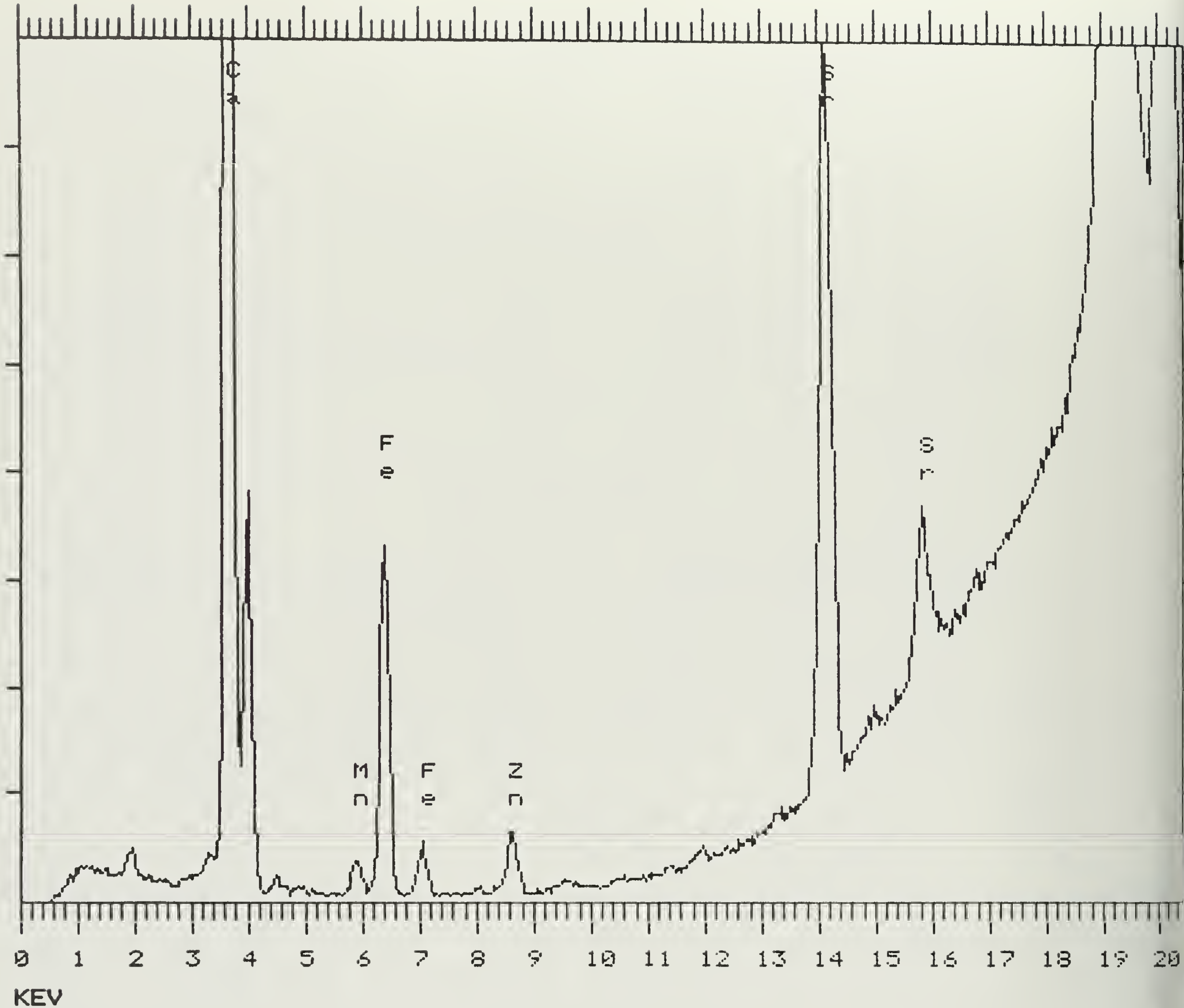
TRACOR-X-RAY SPECTRAL DISPLAY

SPECTRUM: BONE

TUBE VOLTAGE: 10 KV
TUBE CURRENT: 0.04 mA
ATMOSPHERE: VACUUM

FILTER USED: NO FILTER
LIVETIME: 100 SEC

F.S. = 16K



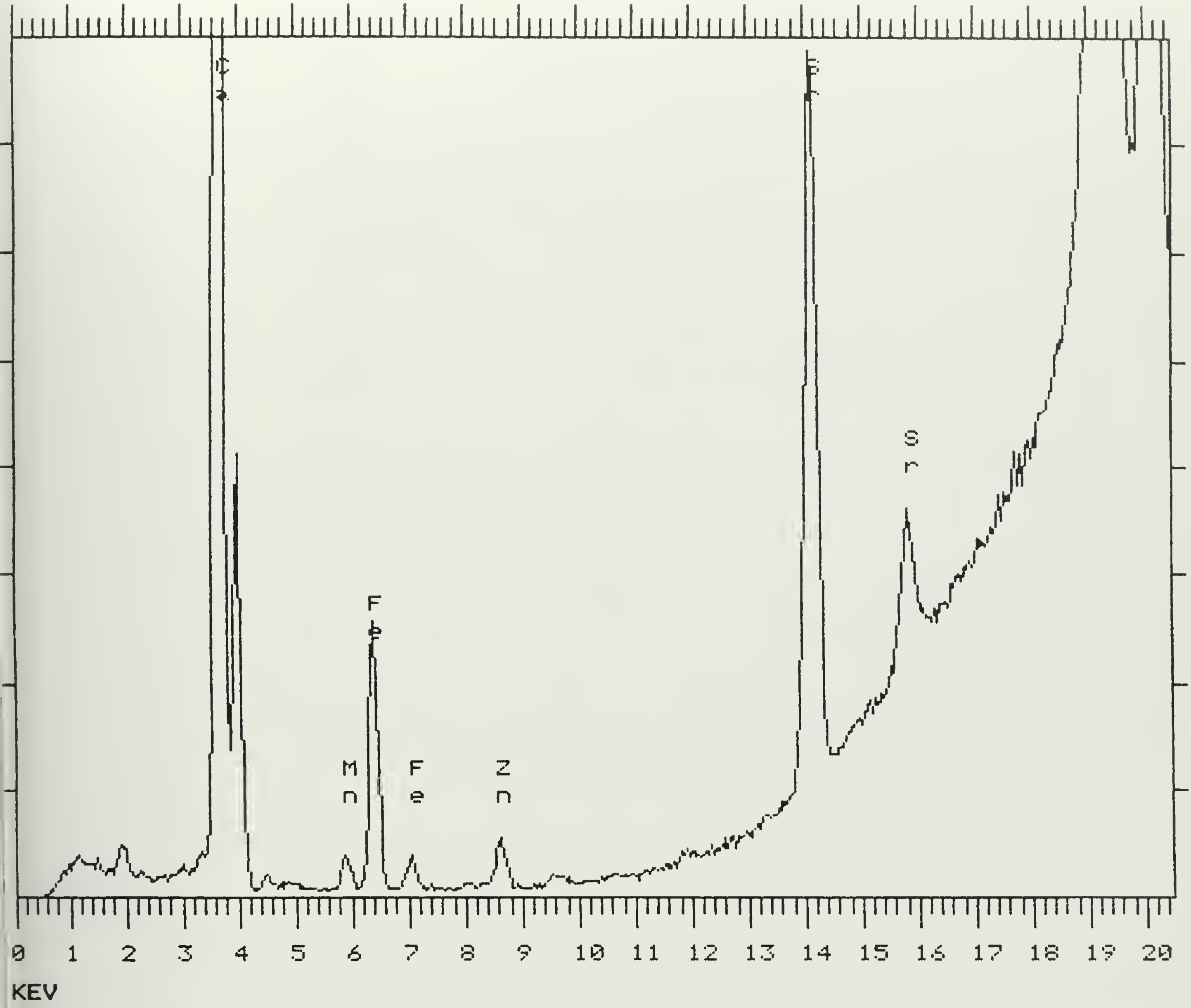
TRACOR-XRAY SPECTRAL DISPLAY

SPECTRUM: BONE

TUBE VOLTAGE: 30 KV
TUBE CURRENT: 0.10 mA
ATMOSPHERE: AIR

FILTER USED: THIN
LIVETIME: 100 SEC

F.S. = 2K



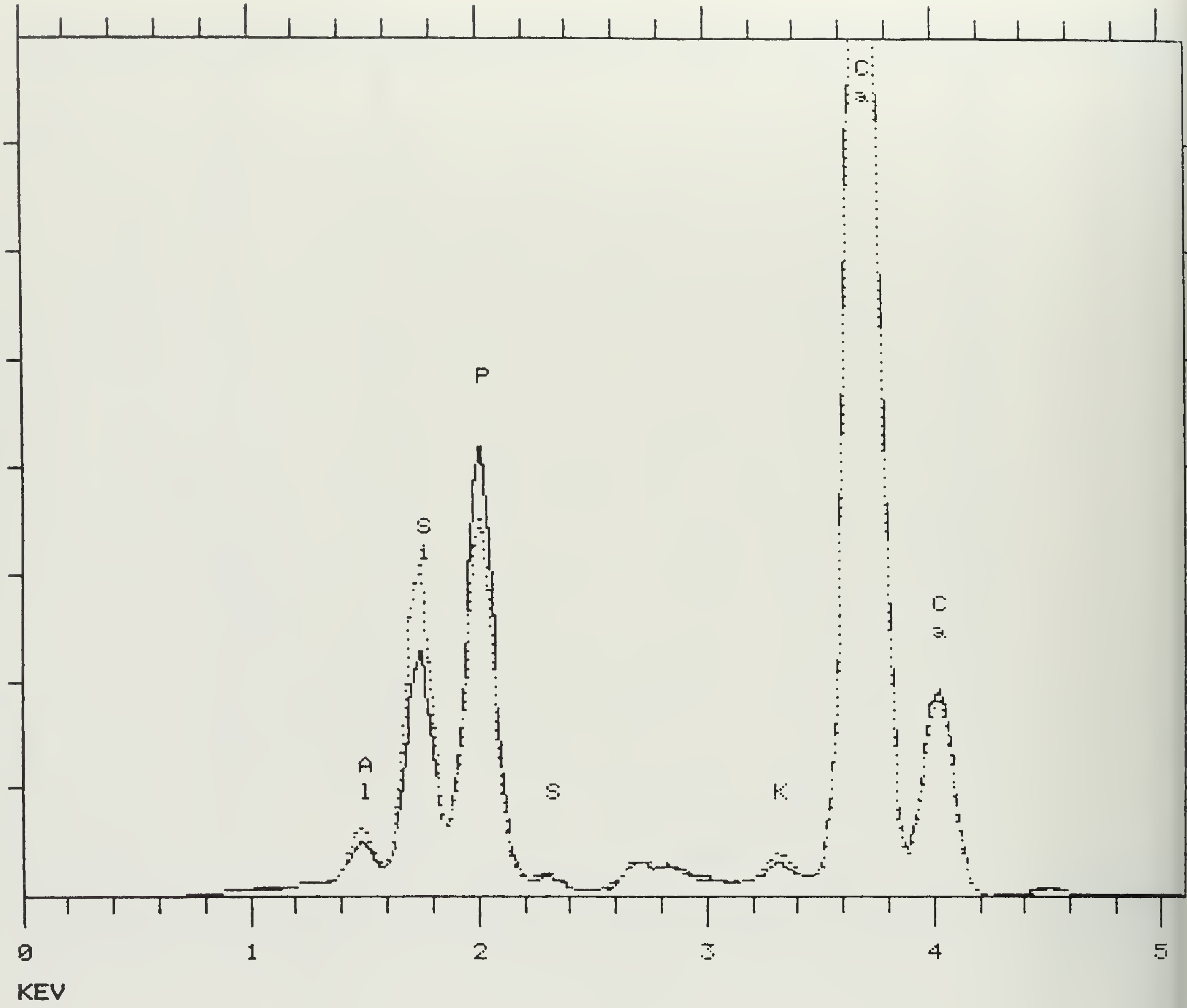
TRACOR-XRAY SPECTRAL DISPLAY

SPECTRUM: WASHED BONE

TUBE VOLTAGE: 30 KV
TUBE CURRENT: 0.10 mA
ATMOSPHERE: AIR

FILTER USED: THIN
LIVETIME: 100 SEC

F.S. = 2K



TRACOR-XRAY SPECTRAL DISPLAY

SPECTRUM: WASHED BONE
(dots: unwashed bone)

TUBE VOLTAGE: 10 KV
TUBE CURRENT: 0.04 mA
ATMOSPHERE: VACUUM

FILTER USED: NO FILTER
LIVETIME: 100 SEC

F.S. = 32K

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Cultural Resource Management Report

Mobil Oil Corporation

Dolores County, Colorado

NOTE: Locational Data Has Been Deleted

Lead Field Investigator Brian O'Neil, M.A.

Principal Investigator Marcia J. Tate

Date August 1, 1984 For Mobil Oil Corporation

P E C

POWERS ELEVATION

CHERRY CREEK PLAZA, SUITE 1201
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Archæology Division

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MOBIL OIL CORPORATION

TEST EXCAVATIONS AT 5DL975

By Brian O'Neil

July 1984

Introduction

The surface indications of prehistoric occupation of the site consisted of a small area of sandstone rubble piled against the southern exposure of a large sandstone boulder. Additionally, another alignment of sandstone slabs indicating another possible room, and a relatively sparse scatter of ceramic sherds and lithics along the edge of the terrace were included. Analysis of the artifacts collected during the survey indicated that the site was probably occupied during the Late P II and Early P III periods. The entire site is approximately 20 meters long and 12 meters wide covering an area of approximately .05 acre. The site at that time was considered to be in a poor state of preservation and was therefore not recommended for inclusion on the National Register of Historic Places.

The site was located along the northeastern edge of the proposed well location, within the direct area of impact

of the proposed project. Consultations between the San Juan Resource Area of the Bureau of Land Management, and Mobil Oil Corporation concluded that the proposed well location could not be relocated in order to avoid site 5DL975. Consequently, negotiations between BLM, Mobil Oil Corporation, and Powers Elevation resulted in a decision to conduct test excavations at 5DL975, and to alter the well pad design so as to minimize disturbance of the site. The recommended well pad layout relative to 5DL975 is illustrated in Figure 2.

Environmental Setting

5DL975 is situated on the southeast side of Squaw Canyon atop a small terrace remnant situated approximately 30 feet above Squaw Creek. Squaw Creek flows approximately 30 meters to the northwest in a broad sweeping curve toward the southwest, around the northwestern edge of the flood plain which lies between the terrace and the creek. This flood plain is approximately 200 feet wide by 1000 feet long and is well suited for small horticultural fields. Large and small sandstone boulders are present in the stream bed and have created small backwaters which could be improved by check dams to provide potential small scale irrigation sources for horticultural activities.

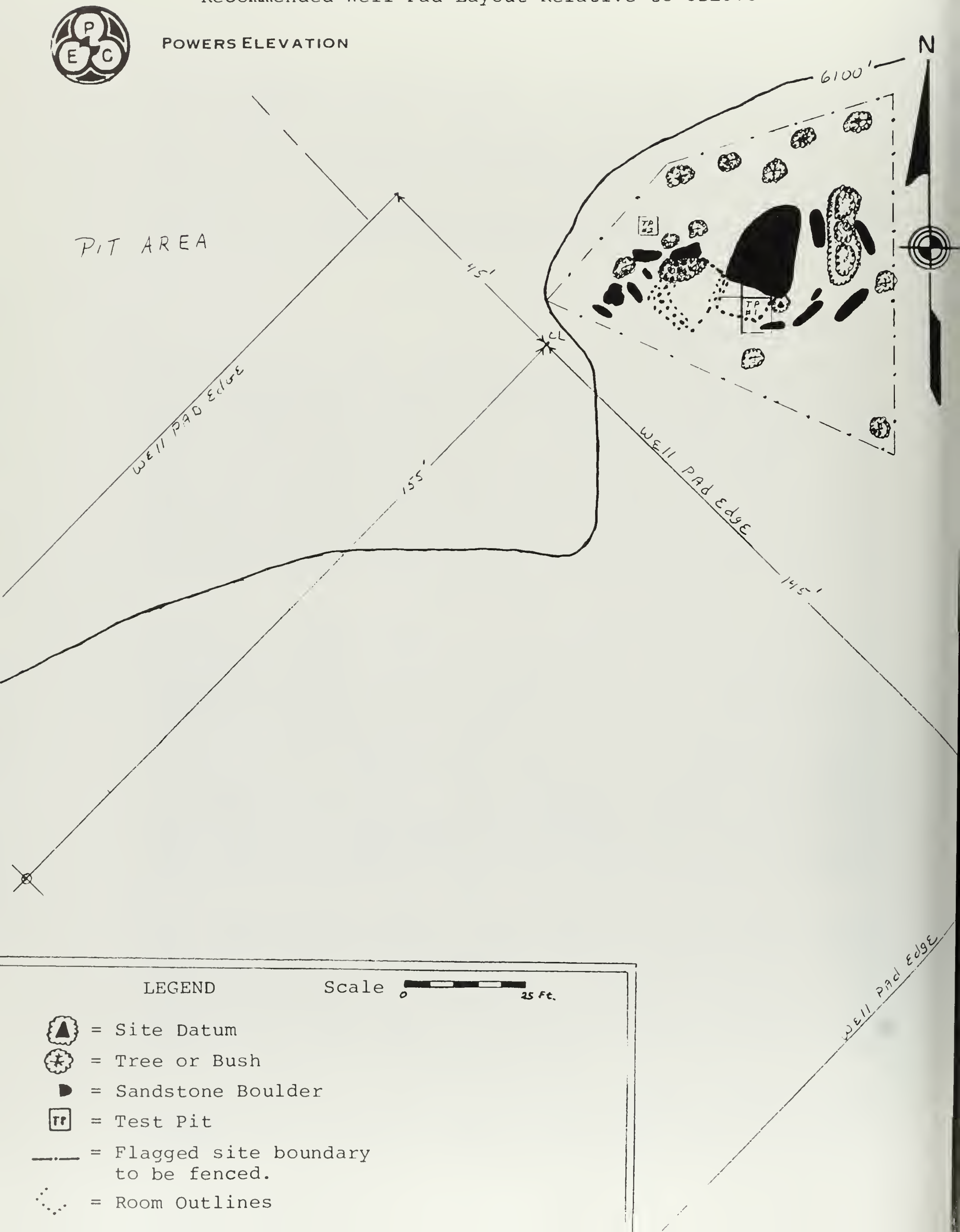
Situated at an elevation of 1859 meters, 5DL975 is located in the Upper Sonoran vegetation zone. The dominant vegetation cover at the site is pinon (Pinus edulis), juniper (Juniperus osteosperma), mountain mahogany (Cercocarpus montanus), oak brush and big sagebrush (Artemisia tridentata). Various grasses and forbs are also present. In addition, squawbush (Rhus trilobata), willow (Slix amygdaloides), and cottonwood (Populus sargentii) are found near the stream bank. Narrow leaf yucca (Yucca angustissima), prickly pear (Opuntia), and Indian rice grass (Oryzposis hymenoides) are also present as are Sego lily (Calochortus nuttallii), and wild onion (Allium) but these are generally dispersed throughout the area.

It is important to note that the area approximately 20 meters to the west of the site, on the flood plain, has been cleared of pinon and juniper trees and is dominated by big sagebrush. This area is approximately one acre in size and was possibly utilized as a horticultural area. Other areas of the flood plain, as well as the slopes of the canyon walls are dominated by moderately dense stands of pinon-juniper with brush understory.

Small marshy areas are present in the little backwater along Squaw Creek, providing suitable habitat for the mosses,

FIGURE #2

Recommended Well Pad Layout Relative to 5DL975



algae, and cattails which are present. Intrusive stands of tamarisk (Tamarisk pentandra) are also present. Whether these small marshy areas were present during the prehistoric occupations of the site is unknown at this time. Domestic water would probably have been available from Squaw Creek itself or from other seep springs which are present in the area.

The climate of the area is a typical pattern of low humidity, wide diurnal temperature fluctuations, mild summers, and cold, relatively dry winters. The annual precipitation ranges from 400 to 500 mm, occurring primarily from winter snows and late summer thunderstorms. Data compiled at the National Weather Service Station at Yellow Jacket, Colorado indicates an average growing season of between 120 to 130 days.

The light orange/brown loess soils near the site are suitable for agricultural purposes, having developed into sandy clay loams mixed with colluvium composed of small pieces of sandstone and shale talus along with large boulders and cobbles derived from the Morrison, Summerville, and Entrada formations. Testing revealed that the soil depths on the site range from .20 meter to 1.3 meters on the flood plain.

Slope on the site is variable from a 2 to 10% grade with the surrounding canyon walls ranging from 20 to 80% grades. Exposure is primarily northwesterly.

Cultural Setting

Within an approximate one mile radius of 5DL975 are three larger habitation sites assigned to the Pueblo II period and which hold the potential of being contemporaneous in their occupation span. These are 5DL64, 5DL586, and 5DL588. Additionally, another Late P II, Early P III fieldhouse site, 5DL976, may also have been used on a seasonal basis by members of one of these larger local communities.

Although it is impossible to tell at this time whether sites 5DL975 and 976 were used by the same occupants, it seems likely that both were used by members of the same community. Another possibility is that site 5DL976 was constructed in response to the demise of the individual buried at 5DL975.

Due to the location of 5DL975 near these larger habitation sites, it is believed that the site represents an outlying area used by the inhabitants as a location where individuals from a household associated with one of the larger communities

FIGURE #3

Looking east-northeast at 5DL975 prior to testing.

could carry out horticultural and/or hunting and gathering activities from the spring planting to the fall harvest.

Testing Procedures

As previously stated, the surface indications at 5DL975 consisted of a small rubble mound against the southern exposure of a large sandstone boulder, another alignment of sandstone slabs indicating a second room, and a sparse scatter of ceramic sherds and lithics along the edge of the terrace. No depressions which might indicate pit structures were observed (see Figure 3).

The original testing objectives were to: prepare a more accurate and detailed map of the site; record any architectural features; recover a representative sample of the material culture; determine the depth and condition of the site for further evaluation of eligibility to the NRHP,and; collect data regarding the potential types and extent of the activities performed by the prehistoric occupants of the site.

The investigation was initiated by establishing a reusable datum located at a juniper tree near the northeastern corner of the rubble mound. A 20 penny nail was driven into the side of the tree to serve as a stable point for vertical control. Next, the surface features of the site were mapped using a Brunton compass and tripod with a 30 meter tape utilizing azimuth and distance readings to selected points. Two testing units were then laid out utilizing the cardinal directions based upon true north with a magnetic declination of 13 1/2 degrees based upon the 1978 USGS determination. Test pit #1 was established in the rubble mound (Room #1) with dimensions measuring 1.5 meters E-W x 2.0 meters N-S. Test pit #2 was established along the western edge of the site in the trash midden with dimensions measuring 1.0 meter E-W x 1.0 meter N-S.

Test pit #2 was excavated by natural levels utilizing both trowel and skim shoveling techniques to a depth of approximately 5 cm below the present ground surface where culturally sterile soils were encountered. (See Figure 4 and 4.5). All dirt was screened utilizing a 1/4" wire mesh screen.

Room #1 was excavated by removing the sandstone rubble and troweling out the fill between the rocks. Controlling for depth and horizontal provenience was extremely difficult due to the jumbled position of the rocks and disturbance by rodents in the upper fill. Point plotting was utilized whenever possible. All dirt was screened through a 1/4" wire mesh screen.

FIGURE #4

Test Pit #2 prior to excavation.

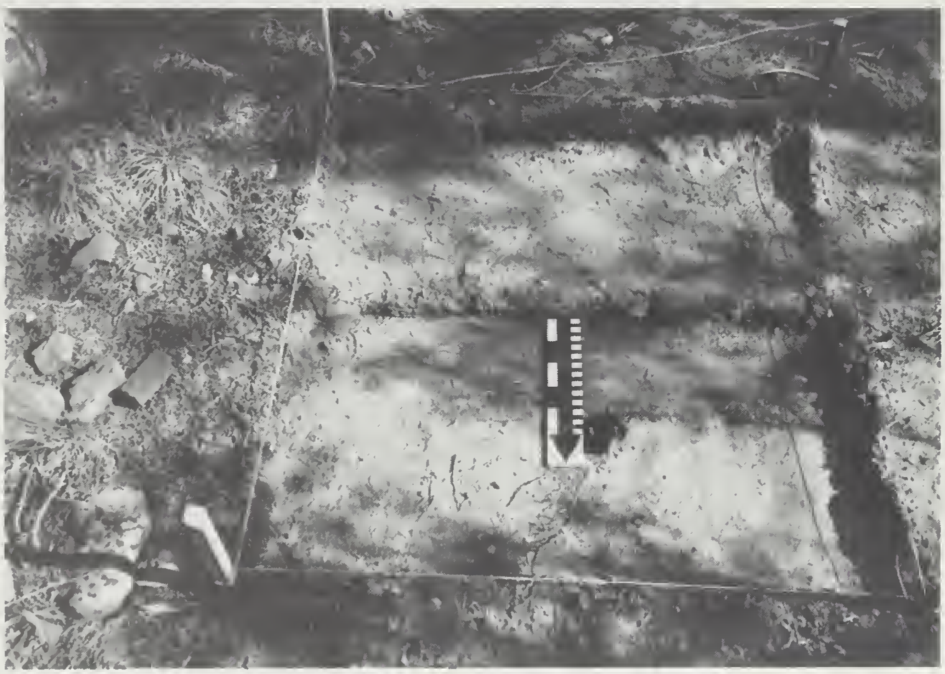


FIGURE #4.5

Test Pit #2 after completion.

Due to the disturbance by rodents which had established a nest in the upper portion of the rubble mound, several arbitrary levels were established based upon statistical averaging of a number of depth readings taken during the excavation of Room #1. Four levels were then arbitrarily defined. Level I consisted of juniper duff extending from the surface of the rubble mound at a depth of -15 cm from Datum #1 (D_1) to a depth of approximately -27 cm D_1. Level II consists of the rodent nest itself with extends from approximately -28 cm D_1 to approximately -39 cm D_1. Level III consists of the root zone formed by the nearby juniper trees and extends from approximately -40 cm D_1 to -63 cm D_1. Level IV consists of the floor fill and was arbitrarily set as the 10 cm immediately above the floor of Room #1 and extends from approximately -64 cm D_1 to -74 cm D_1.

Once the burial was encountered in Test pit #1, a second excavation unit was laid out to the north and designated Test pit #1.5. As the foundations of the walls were exposed in the rubble concentration, Test pits #3 and 3.5 were opened to the west of Test pits #1 and 1.5. All plotted artifacts were measured in from the main E-W, and N-S grid lines which define these four test pits within Room #1. When the limits of the room and the floor had been defined, and the burial removed, a small 40 x 40 cm sub-floor test pit was excavated to determine if any additional floors or cultural deposits were present.

The burial in Room #1 was excavated using a dental pick and a nylon-plastic probe in order to avoid damage to the bone during excavation. Once the burial was exposed, a 50 cm grid system was laid out and the skeleton was recorded according to these mapping units (1 through 6). All fill from around and below the burial was screened separately through 1/4" wire mesh screen.

The burial was then wrapped and packaged and sent to the State Archaeologist at the Colorado Heritage Center in Denver, at his request, in compliance with state policy on the removal of Native American interments. Analysis and disposition of the skeleton will be determined through consultation with the Colorado Commission on Indian Affairs.

A bulk soil sample was taken from beneath a sandstone slab next to the burial, and a single charcoal sample was taken from the fill matrix below the burial. No material was available for dendrochronological samples.

Relative cross dating by ceramics and/or projectile points is the only means of dating available at the present.

Artifacts were collected according to both artificial and cultural provenience units. A catalog of all collected cultural materials is appended.

Upon completion of the excavation, a sheet of clear plastic was laid down upon the floor and Room #1 was backfilled to preserve it. Photographs of the backfilled room, and the excavation in progress are also appended.

Results of the Test Excavation

Architectural Units

Architectural remains at 5DL975 consist of one storage/living room (Room #1), which contained a burial, and another unexcavated series of rubble wall outlines which may be two additional storage rooms. In addition, there is a high probability of exterior occupation/activity areas located to the south of Room #1 and to the east of the large sandstone boulder. (See Figures 5 and 5.5).

Room #1

Dimensions:

Length (NW-SE)	2.01 m (averaged)
Width (NE-SW)	1.85 m (averaged)
Depth (below ground surface)	.28 m (ageraged)
Floor area	3.72 m
Wall height	.50 m (avg. from remnants)
Orientation (azimuth)	207 degrees

Room #1 is a small, nearly square structure, oriented south-southwest from the face of a large sandstone boulder which serves as the back wall of the room.

Wall remnants composed of five courses of unshaped sandstone slab masonry are present near the back of the room adjacent to the sandstone boulder which serves as the rear wall. In addition, there is evidence of a joined wall leading into Room #2 in the west wall of Room #1. This evidence consists of two courses of masonry laid at right angles to the direction of the west wall, located approximately midway along its length. Additionally, there is an alignment of stones outside of, and running parallel to, the west wall of Room #1. Whether this represents the original west wall of Room #1 or the east wall of Room #2 is undetermined at present.

POWERS ELEVATION

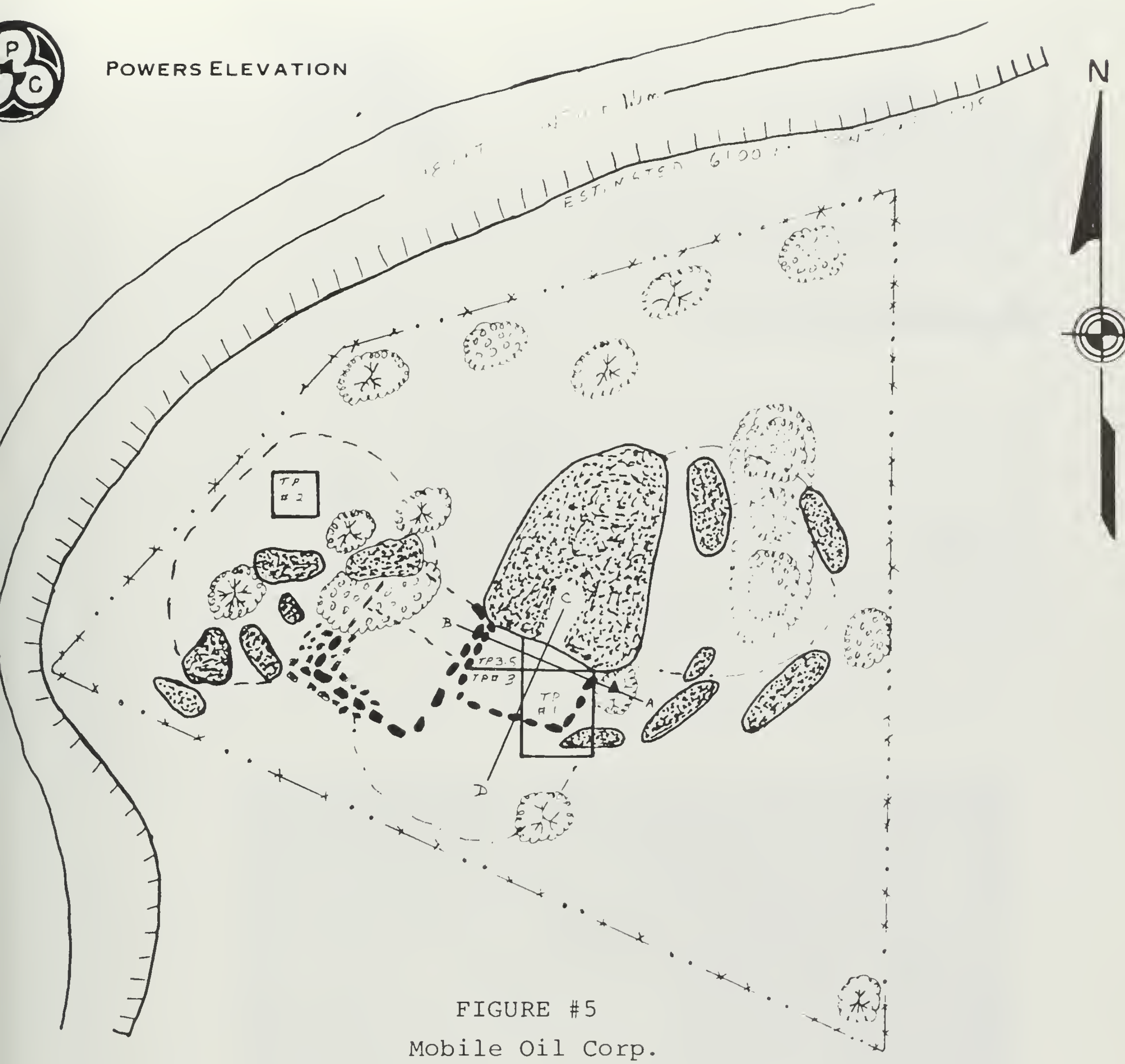


FIGURE #5
Mobile Oil Corp.

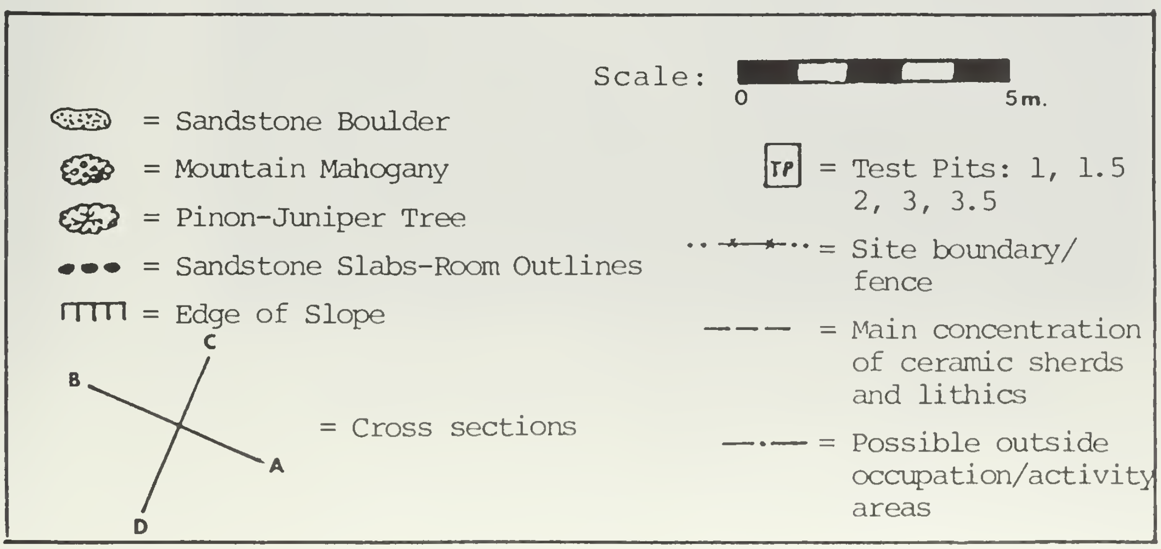
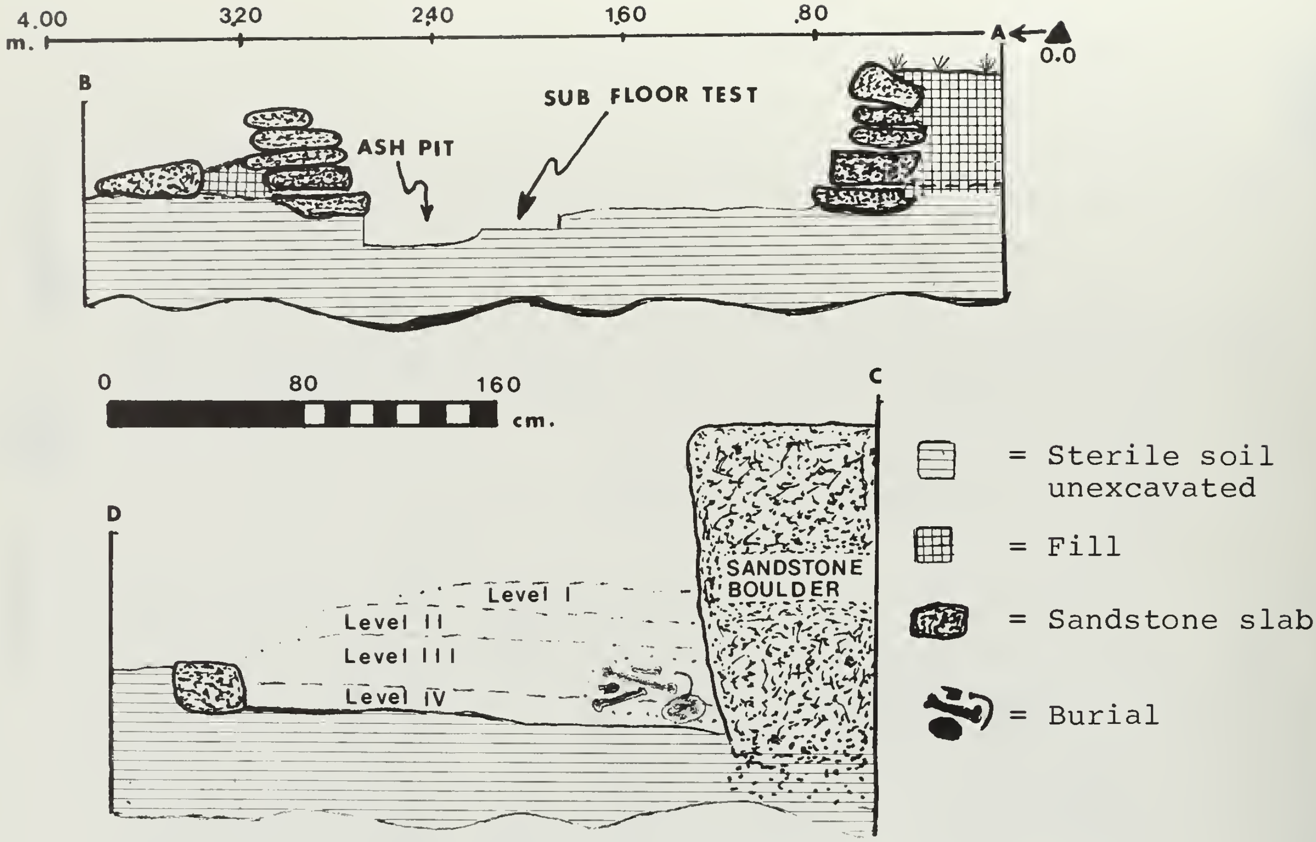


FIGURE #5.5



Cross-sections: A-B, C-D
Room #1, 5DL975

FIGURE #6
Structural fill, Room #1, Test Pit #1.
Southeast corner of Room #1 is visible
5DL975

No evidence of adobe mortar was present between the masonry courses which were still intact. No evidence of a superstructure was present.

Large quantities of building rubble were present in the fill and the available evidence in the positioning of the rocks appears to indicate that the east wall of the structure was pushed in to cover the burial along the back wall (see Figure 6). The spaces between the rocks were filled by juniper duff, rodent debris, and loess deposits with a high frequency of roots.

The floor of Room #1 is located from approximately 25 to 32 cm, sloping northeast, below the modern ground surface. It is marked by hard packed native soil peppered with small pieces of charcoal washed in from burned roots and a lightening struck tree located near the southeast corner of the room. It is otherwise unprepared and uneven. A small subfloor test pit was excavated near the northwest corner of the room to a depth of 5 cm. No additional cultural evidence was encountered. There is an oval shaped depression located in the northwest corner of the room which has tentatively been identified as an ash pit due to its association with an ash lens which overlays it. This feature measures approximately 55 cm by 48 cm. In cross section, the feature is a basin shaped pit with a flat bottom and fairly steep sloping sides approximately 18 cm deep. The ash lens extends an additional 5 cm above the surface of the depression (see Figures 6.5A and B).

The fill consisted of a dark ashy grey silt mixed with sand and small fragments of charcoal from sagebrush. One charcoal sample suitable for C-14 dating was recovered from the fill.

Four artifacts and one turkey bone were associated with the ash lens and pit. However, given the rodent disturbance present, it is possible that this depression represents a rodent burrow which was filled with ash which had washed in from another source. It extends beneath the wall which was the limit of the present test excavations.

Given the discrete concentration of ash associated with this feature, and the presence of a parallel alignment of sandstone slabs outside the present west wall of Room #1, it is possible that the depression may terminate against the outer rock alignment. This, in conjunction with additional cultural phenomena, may or may not confirm its designation as an ash pit and extend the present dimensions and configuration of Room #1.

FIGURE #6.5a

Looking northwest at ash lens
to left and below scale. Room #1

FIGURE #6.5b

Looking west-northwest at ash lens
and possible ash pit in profile. Room #1. 5DL975

Three artifacts were recovered in situ from the floor of Room #1, with an additional four recovered from the 10 cm of level IV designated as the floor fill (see Table 1). These include: three undiagnostic ceramic sherds, one McElmo B/W sherd, a bone awl, and two side-notched, triangular projectile points. Artifacts associated with the ash lens and pit should also be considered as floor artifacts. Figures 7, 8, and 9 are a composite overlay of artifacts, burial, and floor relationships.

Room #2

Room #2 was left unexcavated as it was outside the scope of the testing project. However, surface manifestations recorded during the site mapping are worthy of mention.

Room #2 appears to be situated at an approximate right angle to Room #1, thus giving the overall architecture of 5DL975 an "L" shaped appearance.

Room #2 is approximately 3.20 m long by 2.40 m wide. The foundation stones are obscured by rubble concentrations along the west, and portions of the south walls. Three courses of unshaped sandstone slab masonry appear to be present at the northeast corner where it abuts Room #1 and the large sandstone boulder. In addition, there are two courses of sandstone slabs laid at right angles to, and incorporated within, the presently defined west wall of Room #1. These are located just above the east-west test pit line at elevations of -38 and -44 cm D_1 respectively (see Figure 9). Given the large size of Room #2 it is plausible that a transverse wall may have divided the presently defined structure into two parts.

The absence of a large rubble concentration along a portion of the south wall and east wall is probably due to the destruction of these walls to provide additional rock for piling atop the burial in Room #1.

The northwest corner of Room #2 is currently covered by a dense growth of mountain mahogany and is probably the best preserved portion of the structure. Further work in this structure is warranted.

Burial

A single human interrment was present along the back wall of Room #1, primarily within the confines of testing units 1.5 and 3.5. The burial had been disturbed by rodent activity, primarily through relocation of the metacarpels and metatarsels

into the upper levels of the room fill. Additionally, some disarticulation of the ribs and vertebrae, right tibia/fibula, and right ulna/radius occurred. However, 90% of the burial was intact, the greatest degree of skeletal absence being among the metacarpels and metatarsels.

The position of the burial and its relationship to floor artifacts and features, along with bones and artifacts from the upper fill is illustrated by a composite overlay in Figures 7, 8, and 9.

The burial was covered by a jumbled mass of building debris, some of which appeared to be remnants of the east wall (as previously illustrated in Figure 6). Aside from that particular incident, no patterned placement of the rocks could be discerned. In fact, gradual slippage of the slabs over the centuries caused marked damage to several of the long bones, vertebrae, and ribs by crushing and grinding. Both the right fibula and the right radius were broken due to unequal distribution of the weight.

Furthermore, the pelvis had been broken in half and crushed at the pubis, splitting the acetabulum and the obturator foramen. Consequently, the sex of the individual is not presently determined and must await further analysis.

No grave pit had been dug, nor was there any evidence of a lining or burial covering. Indeed, all the evidence seems to indicate that the individual was rather hastily interred.

The burial was situated on an ill-defined level possibly due to the collapse of the walls and the rodent activity. The front of the skull rested upon the floor, while the knees rested upon the ash lens previously described (see Figure 10). The provenience and depths below datum for several of the major bones are presented in Table #2. The individual appeared to have been lying on the left side, with the knees and elbows flexed in an extended fetal position, as if asleep.

The weight of the rubble appeared to have pushed the pelvis and the torso backward toward the rear wall while the skull shifted downward onto the face. It is interesting to note that no rocks were lying immediately atop the skull. The nearest sandstone slab to the skull was approximately 9 cm above it.

The age of the individual has not been accurately determined at present, but is estimated to be a young adult approximately 18-25 years, based upon the moderate degree of wear apparent

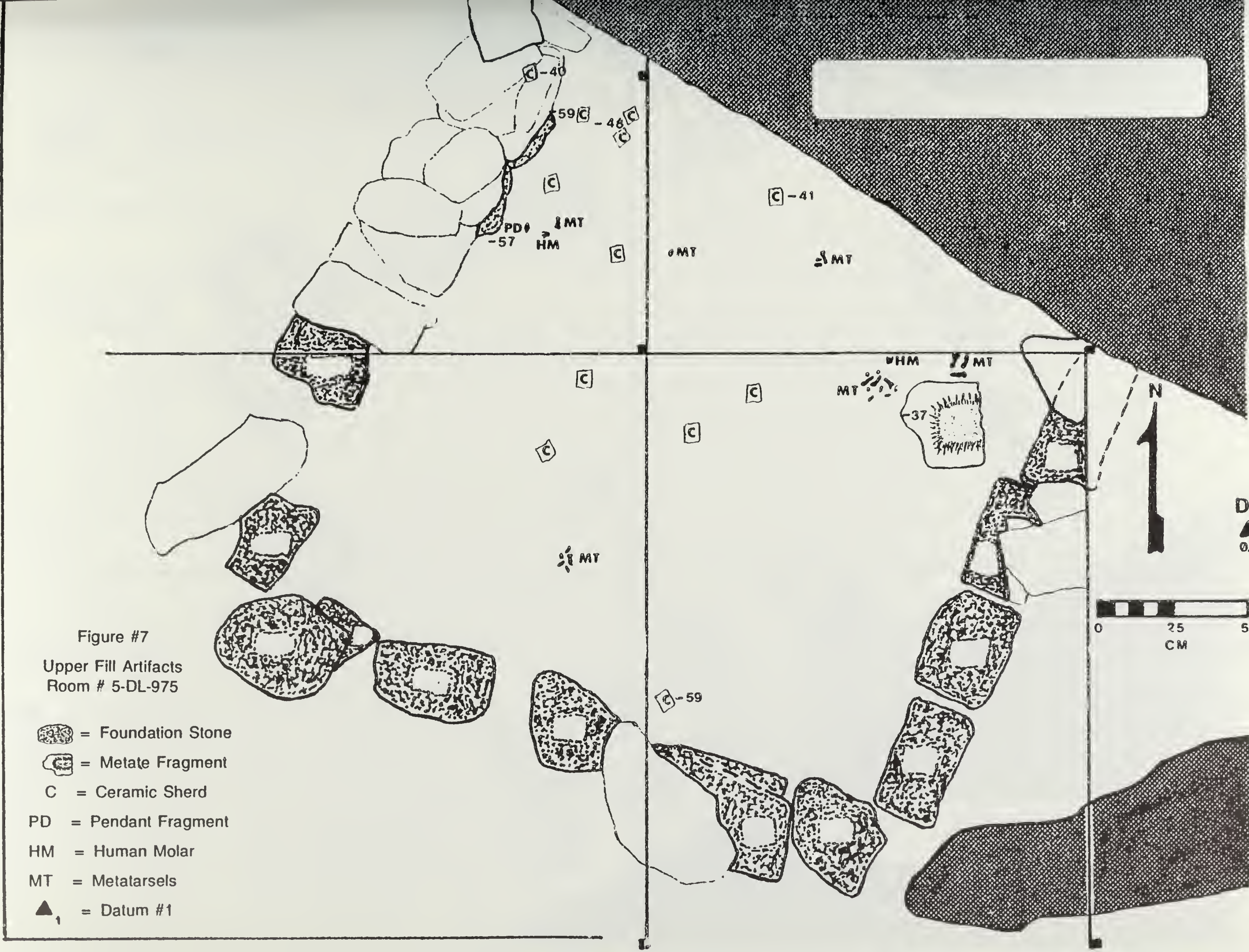


Figure #7

Upper Fill Artifacts
Room # 5-DL-975

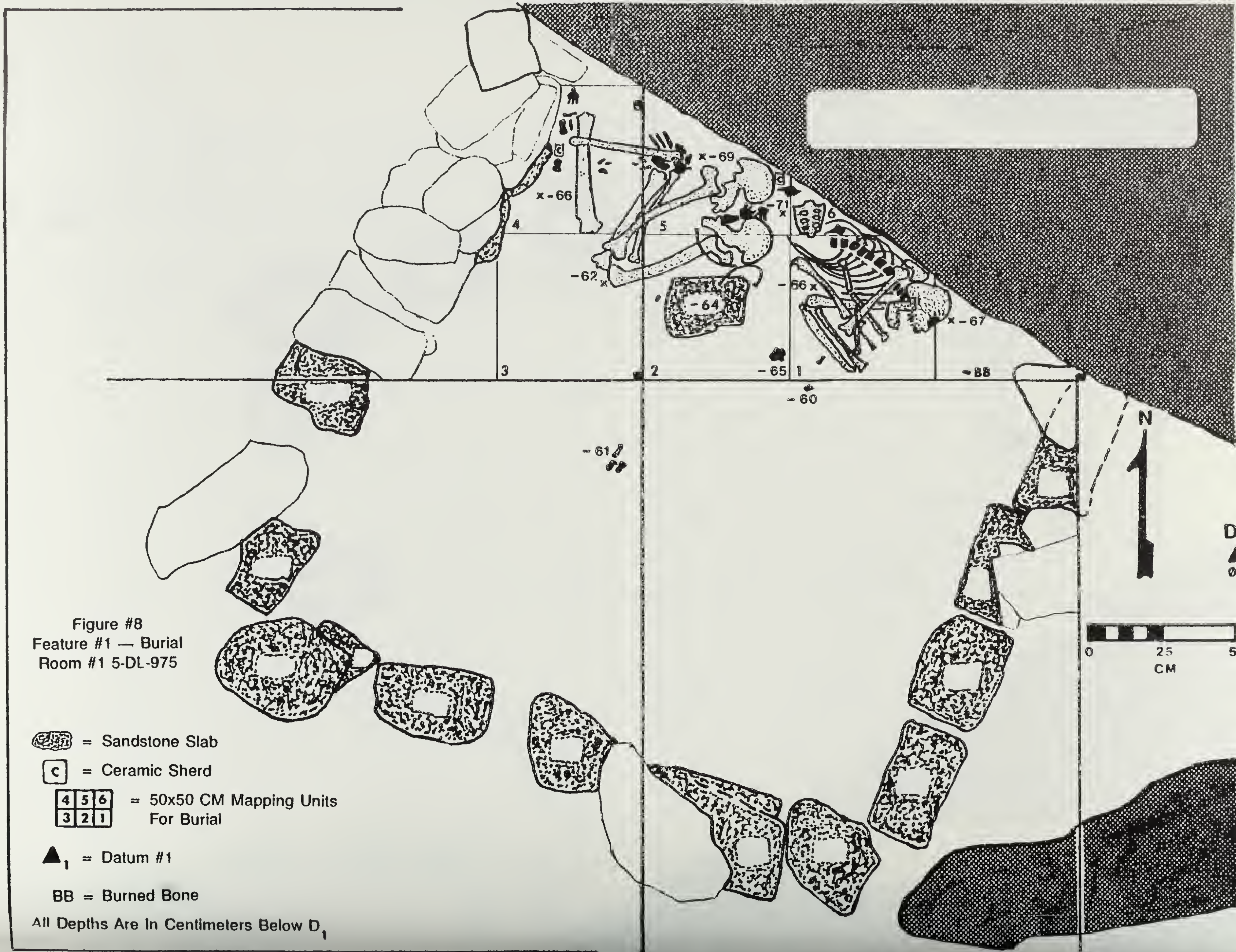


Figure #8
Feature #1 — Burial
Room #1 5-DL-975

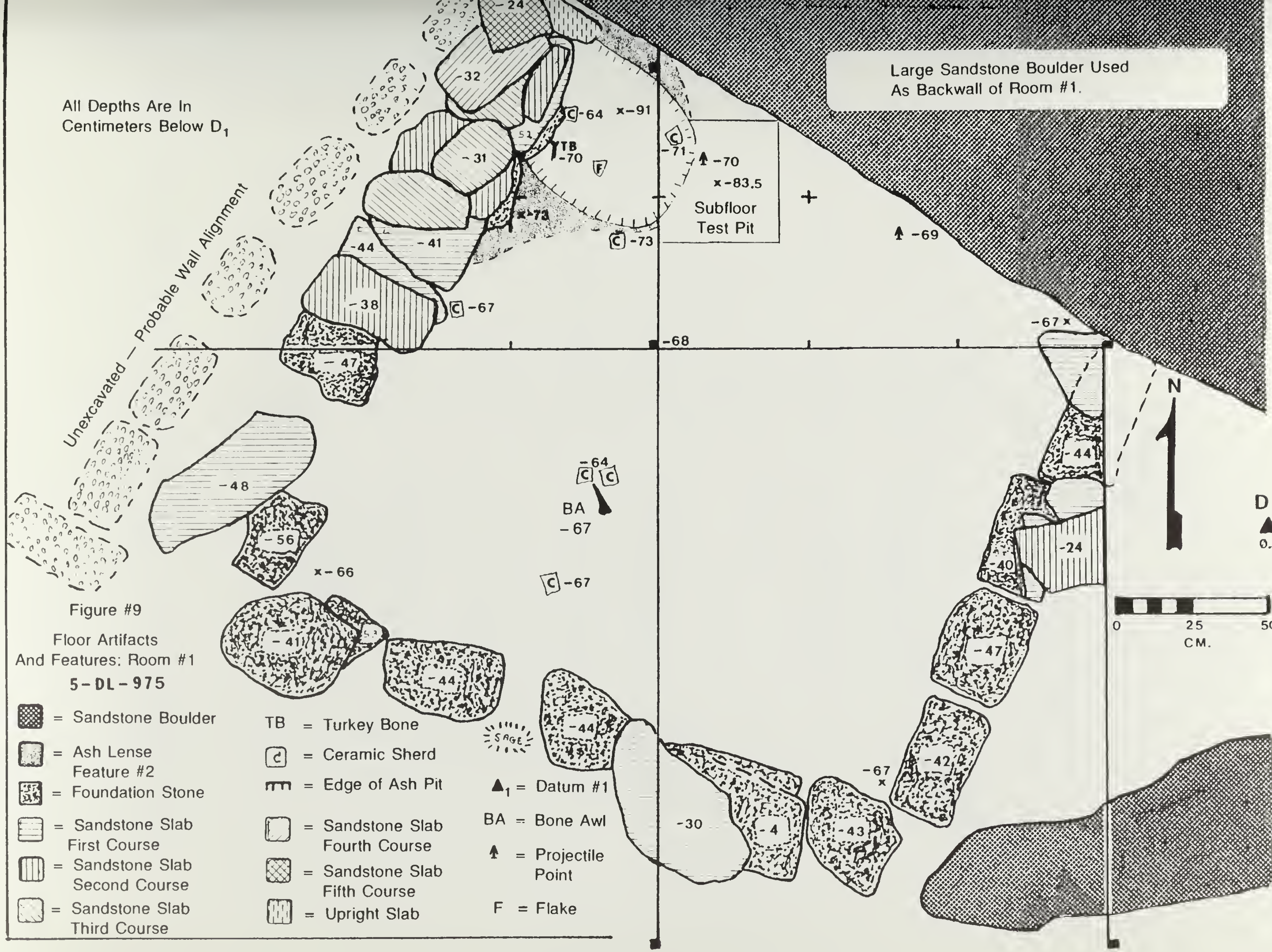


Figure #9
Floor Artifacts
And Features: Room #1
5-DL-975

TABLE #1

5DL975 Room #1

Point Located Floor Artifacts

Mapping Symbol	Description	(in cm.) Location	Depth Below D_1
	Non-diagnostic/ corrugated sherd	TP#3, 44 FNL, 15 FEL	-64
	Non-diagnostic/ B/W sherd	TP#3, 44 FNL, 22 FEL	-64
	McElmo B/W sherd	TP#3, 80 FNL, 36 FEL	-67
	Bone Awl	TP#3, 50 FNL, 20 FEL	-67
	Non-diagnostic/ corrugated sherd	TP#3.5, 12 FSL, 70 FEL	-67
	Side-notched, triangular proj. point	TP#1.5, 63 FSL, 77 FWL	-69
	Side-notched, triangular proj. point	TP#1.5, 61 FSL, 14 FWL	-70
	Non-diagnostic/ corrugated sherd	TP#3.5, Ash pit, 39 FSL, 12 FEL	-73
	Non-diagnostic/ plain white sherd	TP#1.5, Ash pit, 70 FSL, 5 FWL	-71
	Turkey bone	TP#3.5, Ash pit, 66 FSL, 35 FEL	-71

TP = Test pit; FWL = from west line; FEL = from east line; FNL = from north line; FSL = from south line.

TABLE #2

Provenience and Depths Below D_1 of

Skeletal Remains and Associated Features

5DL975 Room #1

Skeletal Remains/ Feature	Provenience	Depth Below D_1 in Centimeters
Top of skull	TP#1.5 Mapping Unit #1	-55
Bottom of skull	TP#1.5 Mapping Unit #1	-67
Bottom of scapuli	TP#1.5 Mapping Unit #1	-69
Top of ulna/radius	TP#1.5 Mapping Unit #1	-63
Bottom of ulna/ radius	TP#1.5 Mapping Unit #1	-66
Lowest vertabrae	TP#1.5 Mapping Unit #6	-74
Top of femur	TP#1.5 Mapping Unit #5	-64
Bottom of femur	TP#1.5 Mapping Unit #5	-69
Top of tibia	TP#3.5 Mapping Unit #4	-60
Bottom of tibia	TP#3.5 Mapping Unit #4	-66
Top of femur	TP#1.5 Mapping Unit #2	-65
Bottom of femur	TP#1.5 Mapping Unit #2	-71
Top of tibia	TP#3.5 Mapping Unit #3	-62

Skeletal Remains Feature	Provenience	Depth Below D_1 in Centimeters
Bottom of tibia	TP#3.5 Mapping Unit #3	-70
Top of pelvis	TP#1.5 Mapping Unit #2	-66
Bottom of pelvis	TP#1.5 Mapping Unit #2	-71
Top of coccyx	TP#1.5 Mapping Unit #6	-60
Bottom of coccyx	TP#1.5 Mapping Unit #6	-68
Top of pelvis	TP#1.5 Mapping Unit #5	-62
Bottom of pelvis	TP#1.5 Mapping Unit #5	-71
Top of ash lens	TP#3.5 Mapping Unit #4	-69
Bottom of ash lens	TP#3.5 Mapping Unit #4	-73
Top of ash pit	TP#3.5 Mapping Unit #4	-73
Bottom of ash pit	TP#3.5 Mapping Unit #4	-91

FIGURE #10

Looking north-northeast at burial, Room #1, 5DL975.
Note position of knees on top of ash lens,
with skull on floor.

on the dentition and the stature. An accurate assessment of the age must await further analysis.

Using a combination of direct skeletal measurement and tabulated formula developed by Genoves (1967), the stature of the individual is estimated to be approximately 157 cm (5'2") to 160 cm (5'3"). This is well within the range observed by Rohn (1971) at Mug House, Cattanach et al. (1980) at Long House, Hayes and Lancaster (1975) at Badger House, and Swannack (1969) from Big Juniper House, in their research on human remains at Mesa Verde National Park.

Deformation of the cranium consisted of a moderate lambdoid flattening, asymmetrical to the left. Additionally, there is a hole and fracturing of the cranium near the lambdoid suture, above the parieto-mastoid suture, with a gash approximately 1 cm wide and 3 cm long extending into the left parietal. The cause of this damage has not been determined, nor is it known if the trauma occurred pre or post mortem. It is interesting to note, however, that the position of the skull was such that the hole was positioned down toward the floor and protected by the large sandstone boulder which forms the back wall of the room (see Figures 11 and 11.5). This, coupled with the absence of rock immediately above the skull would make it seem unlikely that the damage was caused by the rubble over the burial. No indications of impact or damage to the right side of the skull was evident.

The orientation or burial axis is along a 120 degree azimuth with the head toward the southeast and facing south and down. This appears to be primarily a function of the alignment of the large boulder which forms the rear wall of the room, rather than a cultural preference.

Artifacts associated with the burial consist of several corrugated ceramic sherds, a white ware sherd, two B/W sherds, a bone awl, and two side notched, triangular projectile points located directly below the burial. Additionally, a pendant fragment was recovered from the fill above the burial and was probably relocated due to rodent activity.

The time period to which the burial may be assigned is the late P II, early P III period estimated at approximately 1050+/- 25 A.D., based upon relative cross dating of ceramics.

Material Culture

A total of 95 artifacts, in three categories were recovered during the testing operations. These include nonhuman bone, lithic, and ceramic implements.

FIGURE #11
Oblique view of burial and 50 cm.
mapping grids. Scale in centimeters.

FIGURE #11.5
Looking down on burial, Room #1
5DL975. Scale in centimeters.

Faunal and Floral Remains

133 faunal specimens representing three biological orders were recovered during the excavations at 5DL975. Only one of the bones had been worked, a bone awl made from a split mule deer metapodial. The relatively small size of the faunal assemblage permits few interpretations. though several of the species represented may have been used for food by the inhabitants. These would include rabbit, deer, and turkey. The vast majority (103) of specimens recovered are rodent bones. Two are deer, 12 are avifauna, and the rest (16) are presently unidentified or too fragmented to be of use.

Floral remains were extremely scarce and consisted of pinon nuts and juniper seeds from the rodent nest in the upper fill. No evidence of domesticates was encountered. The charred remains of sagebrush branches were recovered from the fill of the ash pit and the fill matrix below the burial. Samples were taken from both these areas and await future analysis.

Ceramics

The ceramic assemblage consists of three wares and five temporarily diagnostic types from the Mesa Verde region. No definable trade ceramics were identified in the assemblage. No whole vessels were present.

The recovered collection can be used to estimate the approximate age of the main occupation at the site. A summary of the ceramic assemblage from 5DL975 is contained in Table 3 (see also Figure 12a and b).

According to Breternitz et al. (1974), Mancos Grey was made during the period A.D. 875 to 950 and represents an intermediate form between the neck banding of Pueblo I and the indented corrugated of Pueblo II. Mancos Corrugated was made from A.D. 900 to 1200, and is known to occur with Mancos Grey and Mesa Verde Corrugated. Mancos Black-on-White was made during the period A.D. 900 to 1150 and is known to co-exist with McElmo Black-on-White and Deadmans Black-on-red. McElmo Black-on-White was made during the period A.D. 1075 to 1275 and perhaps can be extended for 25 years at either end of the time span. It is often found in association with late Mancos Black-on-White and Mesa Verde Black-on-White. Deadmans Black-on-Red was made during the period A.D. 800 to 1000.

From an assessment of the temporally diagnostic types, it appears that the occupation at 5DL975 occurred sometime

FIGURE #12a
Ceramic assemblage from 5DL975

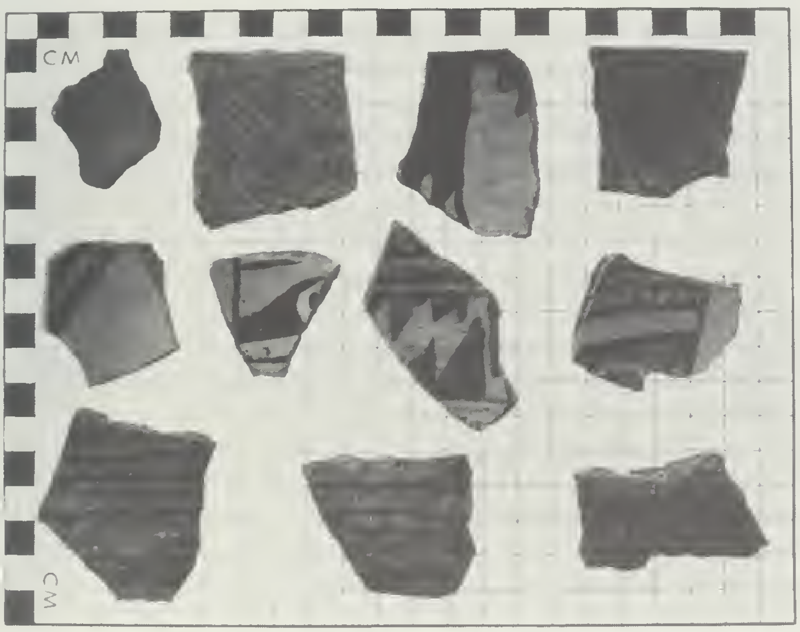


Figure #12b
Ceramic assemblage from 5DL975

TABLE #3

Mesa Verde Ceramics From 5DL975

Ware and Type	Bowl	Jar	Provenience	Number of Sherds Rim	Body	Base	Totals
Gray Wares							12 Gray Wares
Mancos Corrugated		1	Room #1	1			1
Mancos Grey		4	Room #1 (3) and Trash Area		4		4
Unidentified Indented Corrugated		7	Room #1 (6) and Trash Area		6	1	7
White Wares							33 White Wares
Mancos B/W	7		Trash Area (5) Room #1 (2)	5	2		7
McElmo B/W	3	1	Room #1	2	2		4
Unidentified B/W	2	4	Room #1	1	5		6
Unidentified White			Room #1 (15) and Trash Area		15	1	16
Red Wares							1 Red Ware
Deadmans B/R	1		Trash Area TP#2	1			1
Unclassifiable			Room #1 TP#3.5		1		1 Unclassified
TOTALS	13	17		10	35	2	47

during the span A.D. 900 to 1100. A transitional period between late Pueblo II and early Pueblo III, occurring around 1050 A.D. was identified, but not defined, during the Dolores Archaeological Project. This transitional phase falls between the McPhee Phase and the Sundial Phase (Breternitz et. al. 1983: 27).

Based upon the preliminary assessment of the data, the occupation at 5DL975 is believed to have occurred during this undefined phase at approximately A.D. 1050 + 25 years.

Due to the small size of the ceramic assemblage, no estimation was made of the ratio between jar and bowl fragments, and their potential relationships toward determination of primary site function.

It is interesting to note that the P II painted wares came primarily from the trash area, while the later P III painted wares were primarily obtained from the fill of Room #1. Grey wares and corrugates were associated with both areas.

Lithics

A small sample of two flaked stone tools and 45 debitage items were recovered from the survey and testing at 5DL975. The flaked tool inventory consists solely of two projectile points. The debitage items consist of a polyhedral core, thermal shatter flakes, decortication flakes, primary and secondary reduction flakes, primary and secondary thinning flakes, and a few pressure retouch flakes. There was no clustering of these artifacts that would indicate specific work or processing areas. Raw materials used for the flaked stone artifacts and debitage include quartzites, siltstone, basalt and chert. A summary of the lithic debitage analysis data is provided in Table 4.

Virtually all phases of the lithic reduction sequence are present. Approximately 79% of the debitage exhibits a striking platform. 44% of the materials are quartzites, 46% are basalts, 9% are siltstones, and 1% are chert.

Preliminary analysis indicates that there was a primary selection for local materials and that the coarser materials such as the basalts underwent thermal alteration prior to reduction. The two projectile points recovered from below the burial, on the floor of Room #1, are both made of chert and are triangular side-notched. One has an indented base and the other a slightly convex base (see Figure 13). Specific morphological attributes and measured variables are presented in the appendix. Both are similar to P II P III types on Chapin Mesa (Rohn 1977; 208).

Two projectile points associated with burial.

Pendant fragment & bone awl from Room #1.

Polyhedral core from Test Pit #2 - trash area.

FIGURE #13
Artifacts from 5DL975

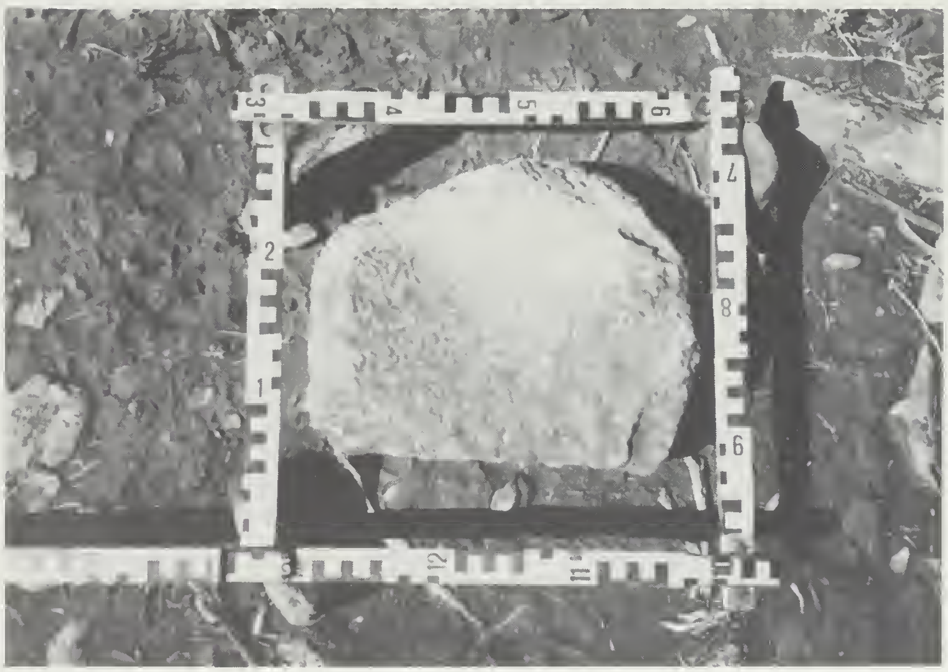


FIGURE #14
Metate fragment recovered from building rubble, Room #1, 5DL975

TABLE #4

Lithic Analysis - Data Summary 5DL975

Speciman Category	Total	Cortex	Platform	Grain Size	Material(s)	Provenience
Thermal Shatter	4	2		Medium Coarse	Quartzite (1) Basalt (3)	TP#2 and Room #1
Core	1	Distal End	1	Medium	Quartzite	TP#2
Primary Reduction	6	3	6	Medium	Quartzite (1) Basalt (5)	TP#2 and Room #1
Secondary Reduction	13		13	Medium Coarse	Quartzite (6) Basalt (7)	TP#2 and Room #1
Primary Thinning	6		5	Medium Coarse	Quartzite (3) Basalt (3)	Room #1
Secondary Thinning	11		7	Medium Coarse Fine	Quartzite (6) Basalt (2) Siltstone (3)	Room #1
Pressure Retouch	2		2	Fine Fine	Quartzite (1) Siltstone (1)	Room #1
TOTALS	43	6	34		Quartzite = 19 Basalt = 20 Siltstone = 4	

Two non-flaked lithic artifacts were recovered from the fill of Room #1. These are a pendant fragment (Figure 13) and a metate fragment (Figure 14). The metate fragment was not collected. Both of these artifacts are of local sandstones.

Preliminary Interpretations

Chronology

Based on ceramic and architectural remains, the occupation at 5DL975 can be placed between A.D. 900 and 1100, or more specifically, in the transitional late P II (Mancos Phase), early P III (McElmo Phase) periods. This also corresponds with an undefined phase between the McPhee and Sundial Phases as identified by the Dolores Archaeological Project. The ceramic assemblage provides the strongest evidence for this chronological placement. The recovered collection includes late Mancos Grey (ca. 900-950 A.D.), Mancos Corrugated (ca. 900-1200 A.D.), Mancos B/W (ca. 900-1150 A.D., McElmo B/W (ca. 1050-1275 A.D.) and Deadmans B/R (ca. 800-1000 A.D.). An estimated and reasonable date for occupation at 5DL975 would be A.D. 1025 +/- 50 years.

The architectural style at 5DL975 is horizontal, unshaped slab masonry which is typical of the Pueblo II period, but is less formalized than the shaped and fitted masonry styles of the later Pueblo III period.

Based upon the available evidence, the length of occupation was probably less than a single generation, perhaps 50 years. There is some slight evidence that architectural remodeling may have occurred at the site in that the east wall of Room #2 may be superimposed over the west wall of Room #1. Further excavation is necessary to confirm or deny this hypothesis. The low density of artifactual materials both in the trash mound and Room #1 probably represent a relatively short period of use.

Two charcoal samples for radio-carbon dating were taken, one from the ash pit, and one from the fill matrix below the burial. However, both of these are suspected to be fragments of burned roots or secondarily deposited fragments from a nearby burned tree and may not provide data on the occupation of the structure. Analysis of these samples awaits further funding.

Adaptation and Economic Activities

5DL975 represents a seasonal locus probably occupied by

a household or sub-household group which resided permanently at a nearby village. Nearby communities of approximately the same period and which are assumed to have practiced a Formative Stage pattern of subsistence and adaptation are: 5DL975, 5DL586, and 5DL588. This involved a primary reliance on the cultivation of domesticated food crops such as corn, beans, and squash, combined with a lesser emphasis on raising domestic animals such as the dog and turkey. Additionally, the hunting and gathering of non-domesticated food was also employed to round out the diet. 5DL975 is believed to have served as a field house or agricultural station in the local community cluster, where a small group of people centered its activities during the growing season and conducted secondary activities relevant to the hunting and gathering of non-domesticated food stuffs. Thus, the site is viewed as a vital component in the local Formative Stage settlement-subsistence system.

At present, no preserved vegetal remains of the common Anasazi cultigens: corn, beans, and squash are available for study. Wild resources such as: pinon nuts, juniper berries, acorns, squaw berries, yucca and prickly pear fruits, Indian rice grass, sego lily, wild onion, and cattail roots are available in the present environment.

In view of the small size of the faunal collection from 5DL975, very little can be conclusively stated regarding which animal species were used at the site or collected in the vicinity. The presence of the bone awl made from a mule deer metapodial, along with turkey and rabbit bones, and unidentified specimens of avifauna indicate that both wild and domestic faunal materials were utilized. However, the procurement, processing, and specific use of these resources cannot be inferred given the present data base.

The artifact assemblage contains elements of both bowls and jars, indicating both serving and storing capacities. Painted white wares outnumber grey utilitarian wares almost three to one, but this probably represents a sampling error due to the nature of the excavation. The lithic assemblage leans heavily toward lithic processing in relation to hunting and gathering/harvesting activities. A single metate fragment is the only piece of ground stone recovered, or observed within the site boundaries.

The presence of the two projectile points would also seem to indicate that more of a hunting or gathering `activity set' took place at 5DL975. However, their direct association with the burial may also be an indicator of the possibility of foul play toward the individual interred in Room #1.

Evidence in the literature for the association of projectile

points, pendants, and bone awls with male burials is present in Hayes and Lancaster (1975:172-175), Cattanach et. al. (1980: 141-149), and Rohn (1971:87-95). There are a total of 15 cases in which one or all of these artifacts were found in association with a burial. Six were identified as male, four as female, and five were of undetermined sex. In no instances were projectile points associated with female burials. Out of a total population of 128 cases, five male burials are associated with projectile points.

Pendants, as an article of personal adornment, are employed by both men and women. The bone awl is also used by both sexes. Indeed, bone awls are such a multi-functional tool, they are useful only as a secondary indicator of tool kit/ activity relationships.

Social Relationships

It has been hypothesized that 5DL975 was seasonally occupied by members of a household unit belonging to one of the larger communities nearby. During the American Formative Stage, the household consisted of the nuclear family, described as the parent pair, their children, and perhaps a few close relatives (Flannery 1976:23). This could mean as few as 2-3 individuals to a maximum of 8-10 individuals.

Room #1 has an estimated floor area of 3.72 m and could only be comfortably occupied by one person. Room #2 has a roughly estimated area of 7.68 m, which is also comfortably suited for occupation by a single person (Narroll 1962). However, since 5DL975 was probably utilized during the warmer months, an enclosed area for sleeping and domestic activities may not have been necessary.

The potential for outdoor activity areas is present to the south and east of Room #1. Further work in these areas, as well as Room #2, is necessary to help establish the potential occupation population. However, it is quite likely that only certain members of the household unit visited and carried out the activities at the field house.

Given the present data base, it can reasonably be inferred from the artifactual and architectural remains, that activities at 5DL975 appear to have focused on gathering/harvesting and possibly hunting activities rather than processing and storage of domestic cultigens. Though some evidence of processing was present, the index of artifact diversity within the assemblage would indicate a greater lean toward manufacturing and hunting (see Pilles 1978:124-125). Furthermore, Nelson et. al. (1978:202) utilized the lithic assemblage from a small classic Mimbres ruin to demonstrate that a

tool kit composed of flakes similar to those at 5DL975, would be effective primarily in the chopping and scraping of gritty fibrous material. This type of activity would be expected at a gathering/harvesting site. Such activity would also be expected during the planting, weeding, harvesting and initial processing of cultivated plants.

Given the proximity to arable land at 5DL975, such activities could have taken place. However, the artifact assemblage at Little House (Breternitz 1983), a site focused primarily on storage and processing, exhibits a significantly higher frequency of ground stone artifacts and storage technologies.

Dean and Lindsey Jr. (1978), working with data from Long House Valley, Arizona, performed a study of functional variability among different types of special use sites. Two types of sites were utilized: Type 1, those with masonry structures; and Type 2, those without. The analysis centered around the relationships among the site types and various features of the physical environment. One of the results was the inability to segregate accurately field residence loci (Type 1) from food collecting stations (Type 2) based upon the presence/absence of masonry rooms.

There is however, a third hypothesis which may relate to the activities at 5DL975. It involves the cultural process of re-occupation and mortuary practices. There is some slight evidence from the trash area and the parallel alignment of rocks outside the west wall of Room #1, that serve to indicate that both rooms may not be contemporaneous.

Indeed, the presence of the Mancos Grey ware, simpler forms of Mancos B/W (See Figure 12a and 12b), and the Deadmans B/R would tend to support a potential occupation pre 1000 A.D., while the Mancos Corrugated, more sophisticated Mancos B/W, and McElmo B/W trend toward a post 1000 A.D. occupation.

As previously mentioned, the P II sherds are primarily associated with the trash area while the P III sherds are primarily associated with Room #1. It is therefore possible that Room #2, more closely associated with the trash area, may slightly pre-date Room #1. If such were the case and it was abandoned, the later inhabitants during the early P III occupation may well have salvaged building materials from Room #2 to build Room #1. This might account for the juxtaposition of the walls, and the superposition of the west wall of Room #1 over an ash pit. Additionally, the projectile points associated with the burial are of types similar to those associated with the Pueblo II and III periods on Chapin Mesa (Rohn 1977:218).

If, during the construction of Room #1, one of the household members came to an unfortunate demise, a logical place for burial would be in the room. It is not uncommon for Anasazi burials to be located in abandoned rooms beneath building rubble and trash. If the deceased was interred in such a manner, and the site abandoned, the proximity of site 5DL976 approximately 305 meters to the south would be a prime alternative for relocation.

Site 5DL976 is composed of four or five rooms, one of which is a depression. It is situated in a similar topographic association with a larger horticultural/floodplain relationship. Checkdams along Squaw Creek may also be evident. The pottery is of the slightly later variety of Mancos B/W and McElmo B/W. A more complete tool kit of lithics and groundstone appears to be present and the density of cultural materials is greater, indicating a potentially longer span of occupation.

Testing of this hypothesis regarding the potential relationship of 5DL975 and 5DL976, relative to post mortem abandonment at 975 and relocation to 976, will require further excavation at both of these sites.

Summary and Recommendations

In conclusion, it appears that 5DL975 is a small field house occupied between A.D. 900 and 1100. It is a seasonal structure utilized by household members of a nearby larger community for a variety of specialized activities ranging from hunting and gathering of local wild resources to horticultural activities. In both cases, the harvests could be stored in the field house to be transported home at an appropriate time.

A flexed burial, interred in Room #1, is estimated to date from approximately 1050 +/- 25 A.D. and may be related to a brief period of occupation prior to the site falling into disuse.

The relationship between sites 5DL975 and 5DL976 is significant both archaeologically and in the context of the project area. The results of testing at site 5DL975 indicate that the site should be considered eligible for nomination to the NRHP. Further testing and/or excavation of both sites is warranted and is likely to yield significant scientific information regarding settlement patterns and resource utilization. This information could contribute substantially to our knowledge of the specialized role of the field house in the food production chain and could help to elucidate

the role of these sites for the prehistoric inhabitants living in the centralized communities around Squaw Canyon.

In view of the above considerations we recommend that the BLM stipulations for construction be followed. That is: fencing of the boundary of 5DL975; alteration of the well pad size and configuration such that the toe of the fill slope does not encroach closer than 20 feet away from the fence; that construction and drilling personnel be restricted from the site, and that access to the location be controlled both during and after completion of the well. Should the sites be endangered by future disturbance, further testing and/or excavation should be performed at the sites prior to such disturbance.

In view of the above considerations, we recommend that the project be allowed to proceed. Should buried cultural materials be encountered during construction, all work should cease and the BLM archaeologist in Durango should be notified.

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APPENDIX

Artifact Catalog

Projectile Point Forms

Photo Record

Excavation Progress Photos

PHOTOGRAPHIC RECORD

PROJECT 5DL975

ROLL # 1
FILM TYPE Fuji Film
ASA 135

DATE	SITE	EXP	DESPCRIPTION	PHOTO	F/SH	CAT. #
5/30	5DL975	1	Looking N at 5DL975, Test pit #1		8/125	
"	"	2	Same as above: arrow points toward metate			
"	"	3	Looking E at 5DL975, Test pit #1			
"	"	4	Same as above			
5/31	"	5	Looking S at Test pit #1-well corner			
"	"	6	Same as above			
6/1	"	7	Looking west wall of Test pit #1			
"	"	8	Same as above			
"	"	9	Same as above			
6/2	"	10	Looking N at Test pit #2 prior to excavation.			
"	"	11	Same as above			
"	"	12	Same as above			
6/3	"	13	Local wildlife			
"	"	14	Local wildlife			
"	"	15	Local wildlife			
6/4	"	16	Looking N at burial			
"	"	17	Looking E at burial			
"	"	18	Metate fragment			
"	"	19	Metate fragment			
6/13	"	20	Burial in progress			
"	"	21	Same as above			
"	"	22	Bone awl-in situ			
"	"	23	Burial in progress			
"	"	24	Looking S at Test Pit #2 after completion			
6/14	"	25	Burial in progress			
"	"	26	Burial in progress-note femur			

PHOTOGRAPHIC RECORD

PROJECT 5DL975

ROLL # 1-2-3
FILM TYPE Fuji Color
ASA 135

DATE	SITE	EXP	DESPCRIPTION	PHOTO	F/SH	CAT. #
6/16	5DL975	27	Burial exposed-prior to mapping		8/125	
"	"	28	Same as above			
"	"	29	Same as above			
"	"	30	Same as above			
6/16	"	31	Burial			
"	"	32	Burial			
"	"	33	Burial			
"	"	34	Burial			
			Roll #2			
		1	Closing shot of burial/room			
		2	Site overviews			
		3	Backfilling			
		4	Backfilling complete			
			Roll #3 KodaColor VR 400			
7/18		1-3	McElmo B/W, Mancos corrugated assemblage from 5DL 975			
		4-6	Deadmans B/R, early Mancos B/W, late assemblage from 5DL975 Mancos grey			
		7-12	Projectile points, pendant fragment, bone awl, core from 5DL975			

ARCHAEOLOGICAL FIELD SPECIMEN INVENTORY RECORD

Sheet No. 1

SITE 5DL975 COLLECTOR Powers Elevation Brian O'Neil DATE May & June 1984

FWL - from west line; FEL - from east line, etc. All measurements are in centimeters from D_1

Field Spec. Number	Description	HORIZONTAL Location	VERTICAL Depth	Association or Remarks	Mus. No.
975-1	Pink/white chert side notched with indented base. Projectile point	TP 1.5 14 FWL 61 FSL	-70 D_1	Just below burial near ribs Room #1	
975-2	Red/brown chert, triangular side notch, indented base. Proj. point	TP 1.5 63 FSL 77 FWL	-69 D_1	Just below burial near pelvis, Room #1	
975-3	Bone awl	TP 3 50 FNL 20 FEL	-67 D_1	Floor of Room #1	
975-4	Pendant fragment	TP 3.5 38 FSL 38 FEL	-57	Fill - root zone	
975-5	McElmo B/W sherd	TP 3 36 FEL 80 FNL	-67	Floor fill	
975-6	McElmo B/W sherd	TP3 Screen	Level III	Fill - root zone	
975-7	McElmo B/W sherd	TP 1 107 FEL 52 FNL	-41	Rodent nest - fill	
975-8	McElmo B/W sherd	TP 3.5 91 FSL 39 FEL	-40	Upper root zone - fill	
975-9	McElmo B/W sherd	TP 1 Screen	Level I	Fill - juniper duff	
975-10	Deadmans B/R	TP 2	Surface	Trash area	
975-11	Mancos B/W	TP 3.5 6.5 FEL 71 FSL	-48	Lower root zone	
975-12	Mancos B/W - sherds (3)	Trash area original survey	Surface	Down slope to NW of site	
975-13	Mancos B/W - sherds (3)	TP 2	Surface	Trash area	
975-14	Mancos corrugated/banded sherds	TP 1	Level II	Squirrels nest	
975-15	Mancos grey	TP 3.5 76 FSL 20 FEL	-59	Burial - above tibia	

ARCHAEOLOGICAL FIELD SPECIMEN INVENTORY RECORD

Sheet No. 2

SITE 5DL975 COLLECTOR Powers Elevation Brian O'Neil DATE May & June 1984

FNL - from north line; FSL - from south line, etc. All measurements are in centimeters from D_1

Field Spec. Number	Description	HORIZONTAL Location	VERTICAL Depth	Association OR Remarks	Mus. No.
975-16	Mancos grey corrugated sherd	TP 1.5	Level III	Lower root zone fill	
975-17	Mancos corrugated rim	TP 3	Level III-IV	Lower root zone just above floor zone	
975-18	Corrugated sherd	TP 3.5 70 FEL 12 FSL	-67	Floor - Room #1	
975-19	Corrugated sherd	TP 3	Level III	Upper root zone fill	
975-20	Corrugated base sherd	TP 1 78 FSL 5 FWL	-59.5	Root zone fill	
975-21	2 B/W & 1 white ware sherd	TP 2	0-5 cm	Topsoil - trash area	
975-22	Sherd and flake	TP 2	Surface	Trash area	
975-23	White ware sherd	TP 1.5 70 FSL 5 FWL	-71	Below burial floor - Room #1	
975-24	White ware sherd	TP 1.5 105 FEL 65 FSL	-61	Burial	
975-25	3 plain body sherds	TP 1	Level II	Fill - squirrels nest	
975-26	4 white and plain sherds	TP 3	Level III-IV	Root zone just above floor	
975-27	White ware sherd	TP 3	Level II	Fill - rodent nest	
975-28	White ware sherd	TP 3.5 5.5 FEL 78 FSL	-48	Lower root zone	
975-29	White ware and corrugated sherds	TP 3.5	Level III	Root zone	
975-30	B/W rim sherd (McElmo)	TP 3.5 78 FSL 29 FEL	-64	Burial	

ARCHAEOLOGICAL FIELD SPECIMEN INVENTORY RECORD

Sheet No. 3

SITE 5DL975 COLLECTOR Powers Elevation Brian O'Neil DATE May & June 1984

FWL - from west line; FSL - from south line, etc. All measurements are in centimeters from D_1

Field Spec. Number	Description	HORIZONTAL Location	VERTICAL Depth	Association OR Remarks	Mus. No.
975-31	B/W and corrugated sherd	TP 3 44 FNL 18 FEL	-64	Floor	
975-32	Mancos B/W sherd	TP 1.5 35 FWL 70 FSL	-53	Root zone	
975-33	Corrugated and white ware sherds	TP 1.5	-50	Root zone above burial	
975-34	Unidentified sherd	TP 3.5 39 FSL 12 FEL	-73	Floor below burial	
975-35	Polyhedral core	TP 2	0-5 cm	Trash area	
975-36	Shatter flakes	TP 2	0-5 cm	Trash area	
975-37	4 flakes	TP 3	-67	Level IV floor fill	
975-38	3 flakes	TP 3	Level III	Root zone fill	
975-39	3 flakes	TP 3.5-ash pit 59 FSL 17 FEL	-82	Ash pit in floor	
975-40	3 flakes	TP 1.5	Level III	Root zone above burial	
975-41	3 flakes	TP 1	Level II	Squirrels nest	
975-42	4 flakes	TP 3.5	Level III	Root zone	
975-43	5 flakes	TP 1.5 W½	Level IV	Floor fill below burial	
975-44	3 flakes	TP 1.5	-50	Root zone above burial	
975-45	7 flakes	TP 3.5	Level III	Root zone	

ARCHAEOLOGICAL FIELD SPECIMEN INVENTORY RECORD

Sheet No. 4

SITE 5DL975 COLLECTOR Powers Elevation Brian O'Neil DATE May & June 1984

SL - from south line; FEL - from east line, etc. All measurements are in centimeters

ld Spec. mber	Description	HORIZONTAL Location	VERTICAL Depth	Association OR Remarks	Mus. No.
75-46	Deer vertebra	TP 1.5 60 FWL 35 FSL	-35	Level II squirrel nest	
75-47	Bird bones	TP 1	Levels II-III	Squirrels nest and upper root zone	
75-48	Burned bone fragments	TP 1.5 38 FEL 3 FSL	-62	Root zone just above floor	
75-49	Turkey bone	TP 3.5 35 FEL 66 FSL	-70	Floor - ash lens	
75-50	Bird bone (?)	TP 1	Level III	Root zone around burial	
75-51	Bird bone	TP 3.5	Level III	Root zone	
75-52	Rodent bones	TP 1	Level III	Root zone above burial	
75-53	Rodent bones	TP 1.5	-56	Root zone around burial	
75-54	Rodent bones	TP 3	Level III	Root zone	
75-55	Rodent bones	TP 3.5	Level III	Root zone	
75-56	Charcoal sample	TP 3.5 37-57 FSL 10-30 FWL	Level IV -80 to 90	Ash pit in floor of Room #1	
75-57	Charcoal sample	TP 1.5 Mapping units #4 and #5	Level IV -64 to 74	From below burial floor fill	
5-58	Soil sample	TP 1.5 Mapping unit #2	Top -65 Bottom -72	Level IV underneath rock next to burial	

AREAL PROJECTILE POINT DISTRIBUTION ANALYSIS AND RECORDING PROJECT

APPDAR PROJECT RECORDING FORM

se Print - One Letter Per Space

REFERENCE DATA:

1.) OWNER: B U R E A U O F L A N D M G M T S J R A
2.) ADDRESS: 7 0 1 C A M I N O D E L R I O
D U R A N G O C O L O 8 1 3 0 1
3.) PHONE: 3 0 3/2 4 7/4 0 8 2 4.) RECORDER: O' N E I L
5.) AFFILIATION/CHAPTER: P O W E R S E L 6.) DATE: 0 7/1 8/8 4
7.) COLLECTION REFERENCE #: 0 5 - D L - 9 7 5
8.) CATALOG #: 5 - D L - 9 7 5
9.) PHOTO: ROLL # ____, EXP. # __, TYPE - B/W __, or CLR X.

LOCATIONAL DATA:

1.) STATE: C O 2.) COUNTY: D L 3.) PHYSIOGRAPHIC REGION: C A N L D S
4.) MAJOR LAND FORM: M O N T E Z U M A V A L L E Y
5.) MAJOR RIVER: S A N J U A N
6.) MAJOR TRIBUTARY: S Q U A W C A N Y O N
7.) SPECIFIC RIDGE or CK.: S Q U A W C K
8.) ADDITIONAL DATA: S E, N W, S E, N E, S E C 2 4 T 3 9 N R 2 0 W

MORPHOLOGICAL ATTRIBUTES, PROJECTILE POINTS (circle in each category) X - FILE

1.) BLADE SHAPE: A. lancelote, B. ovate, C. triangular, D. serrated, E. incurvate, F. parallel ovate, G. expanding ovate, H. sub-triangular.
2.) TRANSVERSE CROSS SECTION: A plano-convex, B. plano-triangular, C. biplano, D. biconvex, E. bitriangular/diamond, F. asymetrically biconvex, G. asymetrically bitriangular, H. convex-triangular.
3.) LONGITUDINAL CROSS SECTION: A. plano-convex, B. biplano, C. biconvex, D. asymetrically biconvex, E. excurvate, F. bitriangular, G. ovate-triangular, H. asymetrically ovate, I. asymetrically excurvate, J. asymetrically concave-convex.
4.) NOTCHING: (circle two...A thru E, and...F or G) A. unnotched, B. sidenotched, C. cornernotched, D. earred, E. basal; F. unground, G. ground.
5.) SHOULDER: (circle two...A thru C, and D or E) A. sharp, B. straight, C. rounded, D. upswept, E. downswept.
6.) STEM: (circle two...A thru E, and...F, G or H) A. expanding, B. slightly expanding, C. straight, D. constricted, E. rounded; F. unground, G. ground, H. undetermined.
7.) BASE: (circle two or three... A thru H, I or J, and K thru M) A. straight, B. subconvex, C. convex, D. subconcave, E. concave, F. triangular-concave, G. bivectoral, H. trivectoral I. unground, J. ground, K. thinned, L. fluted, M. undetermined.
8.) FLAKING PATTERN: A. random, B. collateral, C. parallel, D. oblique, E. chevron, F. fluted.
9.) COLOR: D L P K 10.) MATERIAL: C H
11.) CULTURAL AFFILIATION or TYPE: (if known) A N A S A Z I P II - P III
12.) RELATIVE AGE RANGE: (if known) C A 1 0 5 0 A.D. B.C.

FOR OFFICIAL USE ONLY

APPDAR# ____
LANCELATE (L): __ SIDE NOTCHED (SN): X
STEMMED (ST): __ CORNER NOTCHED (CN): __
TRIANGULAR (T): X INDENTED BASE (ID): X
OTHER (?): __

IV. MEASURED VARIABLES: GENERAL (Y FILE)

1.) Longitudinal Axis (L1): __ 2 3 . 1 mm
2.) Blade Length (L2): . . . __ 1 7 . 1 mm
3.) Stem Length (L3); . . . __ __ 6 . 0 mm
4.) Maximum Thickness (T1): __ __ 2 . 2 mm
5.) Maximum Width (W1): . . __ 1 0 . 8 mm
6.) Shoulder Width (W2): . __ 1 0 . 2 mm
7.) Stem Width (W3): . . . __ __ 6 . 3 mm
8.) Basal Width (W4): . . . __ 1 0 . 8 mm

9.) Thickness (T); [Stem (S) or Basal (B)] circle one (ST) or (BT): __ __ 1 . 8 mm

V. MEASURED VARIABLES: CONVEX or CONCAVE BASE POINTS

1.) Basal Chord Length (BCL): . . . . __ __ 1 . 8 mm
2.) Basal Mid. Ord. Dist (BMD): . . . __ __ 2 . 0 mm
3.) Basal Indentation Ratio (BIR): $\frac{L1-Bmd}{L1}(100)$ = 0 9 1%

Slide Carrier

VI. MEASURED VARIABLES: CORNERNOTCHED POINTS

1.) Distal Shoulder Angle (DSA): Ø Ø Ø°
2.) Proximal Shoulder Angle (PSA): Ø Ø Ø°
3.) Notch Opening Index (NO): Ø Ø Ø°
4.) Max. Width Position (MWP): (100)L3 ÷ L1= Ø Ø Ø%

VII. MEASURED VARIABLES: SIDENOTCHED POINTS

1.) Notch Depth (ND): __ 2 . 5 mm
2.) Notch Width (NW): __ 2 . 5 mm
3.) Notch to Base Length (NBL): __ 4 . 3 mm
4.) Notch Depth - Width Ratio (NDWR): (100)ND ÷ NW= 1 0 0%

X-FILE (III.) (1) C, (2) F. (3) C, (4) B F, (5) A B, (6) B F, (7) E I K, (8) B, (9) D L K, (10

Y-FILE (IV.) (1) Ø 2 3 . 1, (2) Ø 1 7 . 1, (3) Ø Ø 6 . Ø, (4) Ø Ø 2 . 2, (5) Ø 1 Ø . 8,
(6) Ø 1 Ø . 2, (7) Ø Ø 6 . 3, (8) Ø 1 Ø . 8, (9) Ø Ø 1 . 8.
(V.) (1) Ø Ø 1 . 8, (2) Ø Ø 2 . Ø, (3) Ø Ø 9.
(VI.) (1) Ø Ø Ø, (2) Ø Ø Ø, (3) Ø Ø Ø, (4) Ø Ø Ø.
(VII.) (1) Ø 2 . 5, (2) Ø 2 . 5, (3) Ø 4 . 3, (4) 1 Ø Ø.

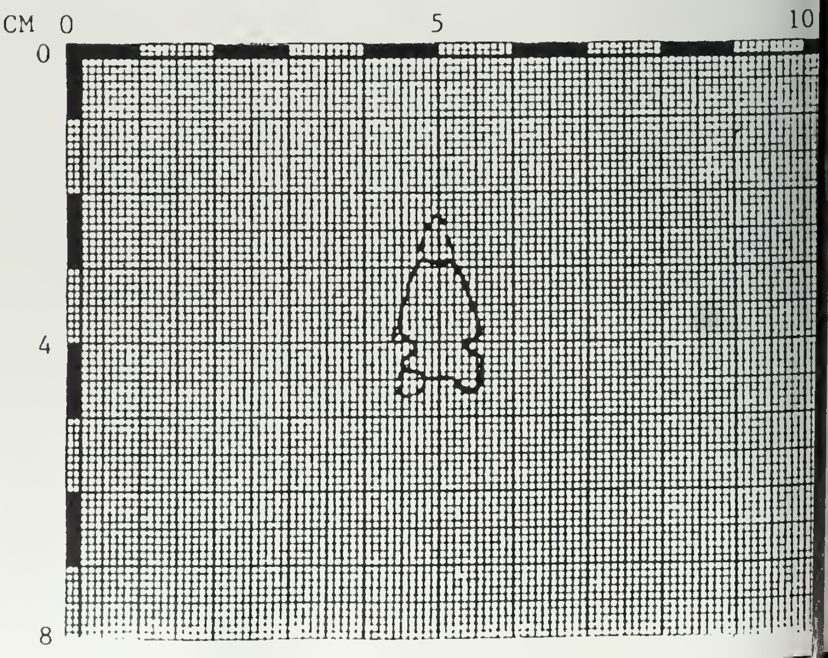
VIII. OUTLINE DRAWING/COMMENTS

Specimen is a mottled purple, pink and white chert possibly from the Summerville formation.

Impact fracture present on tip of blade, tip missing.

Hinged snap fractures on left lateral shoulder...tip, and on lower left spur of indented base.

ecimen exhibits pressure, bi-racial, edge retouch/sharpening.



AREAL PROJECTILE POINT DISTRIBUTION ANALYSIS AND RECORDING PROJECT

APPDAR PROJECT RECORDING FORM

ase Print - One Letter Per Space

FOR OFFICIAL USE ONLY

APPDAR# _ _ _ _ _ - _ _ _ _
LANCELATE (L): _ SIDE NOTCHED (SN): X
STEMMED (ST): _ CORNER NOTCHED (CN): _
TRIANGULAR (T): X INDENTED BASE (ID): _
OTHER (?): _ - _ _ _ _ _ _ _ _

REFERENCE DATA:

1.) OWNER: B U R E A U _ O F _ L A N D _ M G M T _ S J R A _

2.) ADDRESS: 7 0 1 _ C A M I N O _ D E L _ R I O _ _ _ _ _ _ _
D U R A N G O _ C O L O _ 8 1 3 0 1 _ _ _ _ _ _ _ _ _ _

3.) PHONE: 3 0 3/2 4 7/4 0 8 2 4.) RECORDER: O'N E I L _

5.) AFFILIATION/CHAPTER: P O W E R S E L 6.) DATE: 0 7/1 8/8 4

7.) COLLECTION REFERENCE #: 0 5 - D L - 9 7 5 _

8.) CATALOG #: 5 - D L - 9 7 5 _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

9.) PHOTO: ROLL # _ _ _ _, EXP. # _ _, TYPE - B/W _, or CLR X.

LOCATIONAL DATA:

1.) STATE: C O 2.) COUNTY: D L 3.) PHYSIOGRAPHIC REGION: C A N L D S _ _ _ _ _

4.) MAJOR LAND FORM: M O N T E Z U M A _ V A L L E Y _ _

5.) MAJOR RIVER: S A N _ J U A N _ _ _ _ _ _ _ _ _ _ _ _ _ _

6.) MAJOR TRIBUTARY: S Q U A W _ C A N Y O N _ _ _ _ _ _

7.) SPECIFIC RIDGE or CK.: S Q U A W _ C K _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

8.) ADDITIONAL DATA: S E N W S E N E S E C 2 4 _ T 3 9 N _ R 2 0 W _ _

MORPHOLOGICAL ATTRIBUTES, PROJECTILE POINTS (circle in each category) X - FILE

1.) BLADE SHAPE: A. lancelote, B. ovate, C. triangular, D. serrated, E. incurvate, F. parallel ovate, G. expanding ovate, H. sub-triangular.

2.) TRANSVERSE CROSS SECTION: A plano-convex, B. plano-triangular, C. biplano, D. biconvex, E. bitriangular/diamond, F. asymetrically biconvex, G. asymetrically bitriangular, H. convex-triangular.

3.) LONGITUDINAL CROSS SECTION: A. plano-convex, B. biplano, C. biconvex, D. asymetrically biconvex, E. excurvate, F. bitriangular, G. ovate-triangular, H. asymetrically ovate, I. asymetrically excurvate, J. asymetrically concave-convex.

4.) NOTCHING: (circle two...A thru E, and...F or G) A. unnotched, B. sidenotched, C. cornernotched, D. earred, E. basal; F. unground, G. ground.

5.) SHOULDER: (circle two...A thru C, and D or E) A. sharp, B. straight, C. rounded, D. upswept, E. downswept.

6.) STEM: (circle two...A thru E, and...F, G or H) A. expanding, B. slightly expanding, C. straight, D. constricted, E. rounded; F. unground, G. ground, H. undetermined.

7.) BASE: (circle two or three... A thru H, I or J, and K thru M) A. straight, B. subconvex, C. convex, D. subconcave, E. concave, F. triangular-concave, G. bivectoral, H. trivectoral I. unground, J. ground, K. thinned, L. fluted, M. undetermined.

8.) FLAKING PATTERN: A. random, B. collateral, C. parallel, D. oblique, E. chevron, F. fluted.

9.) COLOR: A U _ _ _ _ _ _ _ _ 10.) MATERIAL: C H _ _ _ _ _ _ _

11.) CULTURAL AFFILIATION or TYPE: (if known) A N A S A Z I _ P II - P III _ _ _ _ _ _

12.) RELATIVE AGE RANGE: (if known) C A _ 1 0 5 0 A.D. / B.C.

IV. MEASURED VARIABLES: GENERAL (Y FILE)

1.) Longitudinal Axis (L1): __ 2 7.6 mm
2.) Blade Length (L2): . . __ 2 2.4 mm
3.) Stem Length (L3); . . . __ __ 5.2 mm
4.) Maximum Thickness (T1): __ __ 2.3 mm
5.) Maximum Width (W1): . . __ 1 2.0 mm
6.) Shoulder Width (W2): . __ 1 2.0 mm
7.) Stem Width (W3): . . . __ __ 8.1 mm
8.) Basal Width (W4):. . . __ 1 2.0 mm

9.) Thickness (T); [Stem (S) or Basal (B)] circle one (ST) or (BT): __ __ 2 . 1 mm

V. MEASURED VARIABLES: CONVEX or CONCAVE BASE POINTS

1.) Basal Chord Length (BCL): . . . . __ 1 2.0 mm
2.) Basal Mid. Ord. Dist (BMD): . . . __ __ 1.0 mm
3.) Basal Indentation Ratio (BIR): $\frac{L1-Bmd}{L1}(100)$ = __ 9 6 %

Slide Carrier

VI. MEASURED VARIABLES: CORNERNOTCHED POINTS

1.) Distal Shoulder Angle (DSA): Ø Ø Ø°
2.) Proximal Shoulder Angle (PSA): Ø Ø Ø°
3.) Notch Opening Index (NO): Ø Ø Ø°
4.) Max. Width Position (MWP): (100)L3 ÷ L1= Ø Ø Ø%

VII. MEASURED VARIABLES: SIDENOTCHED POINTS

1.) Notch Depth (ND): __ 1.2 mm
2.) Notch Width (NW): __ 1.3 mm
3.) Notch to Base Length (NBL): __ 4.2 mm
4.) Notch Depth - Width Ratio (NDWR): (100)ND ÷ NW= __ 9 2 %

X-FILE (III.) (1) C, (2) F. (3) C, (4) B F, (5) A B, (6) B F, (7) B I K, (8) A, (9) A U __, (10)

Y-FILE (IV.) (1) Ø 2 7.6, (2) Ø 2 2.4, (3) Ø Ø 5.2, (4) Ø Ø 2.3, (5) Ø 1 2.Ø,
(6) Ø 1 2.Ø, (7) Ø Ø 8.1, (8) Ø 1 2.Ø, (9) Ø Ø 2.1.
(V.) (1) Ø 1 2.Ø, (2) Ø Ø 1.Ø, (3) Ø 9 6.
(VI.) (1) Ø Ø Ø, (2) Ø Ø Ø, (3) Ø Ø Ø, (4) Ø Ø Ø.
(VII.) (1) Ø 1.2, (2) Ø 1.3, (3) Ø 4.2, (4) Ø 9 2.

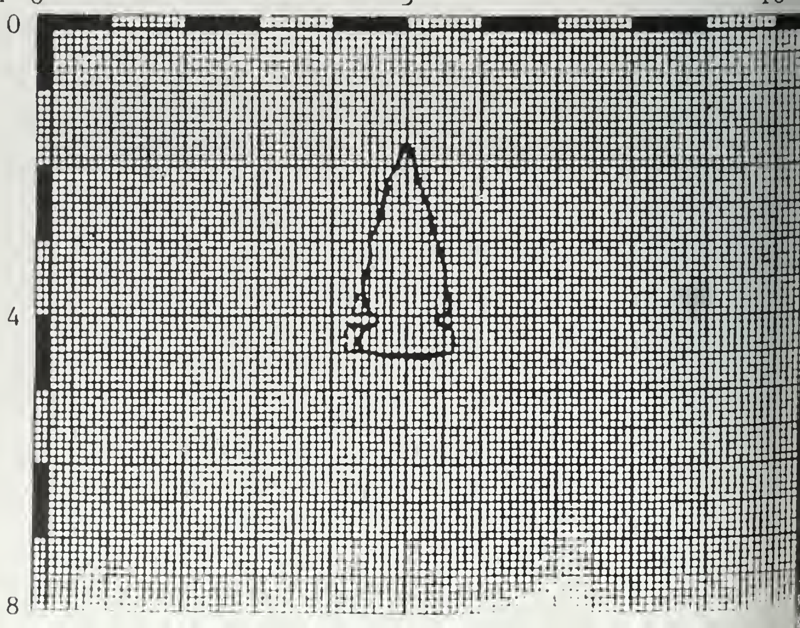
VIII. OUTLINE DRAWING/COMMENTS

Speciman is made from a solid color light reddish brown chert.

A snap fracture is present on the left lateral shoulder and the lower left corner of the stem/base.

Pressure, bifacial, edge retrouch sharpening.

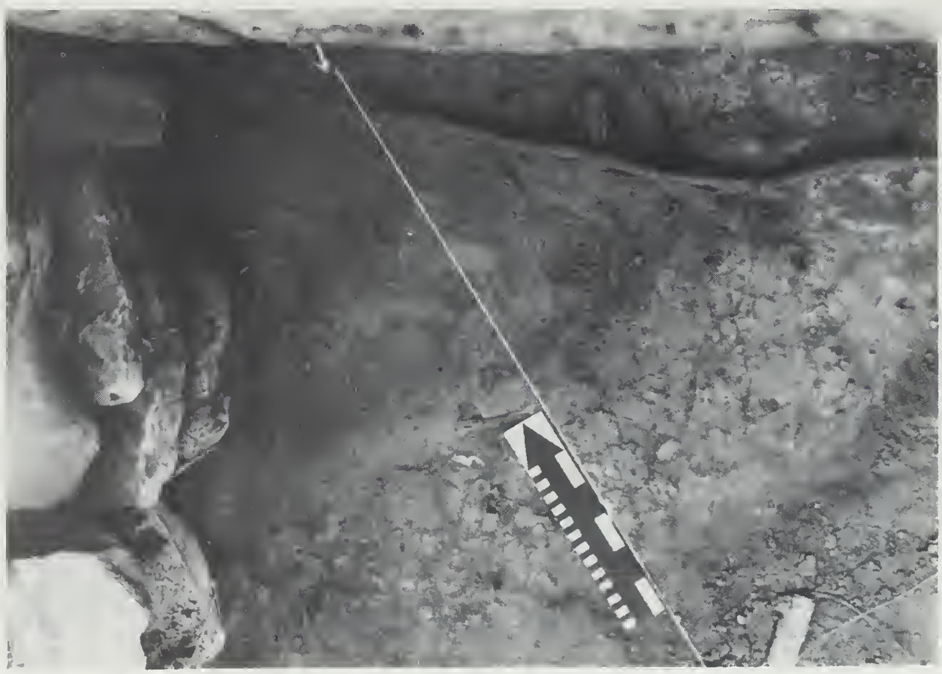
CM 0 5 10



Looking north at initial exposure
of Burial - Room #1, 5DL975

Looking northwest at burial and bone
awl on floor. Room #1, 5DL975

Looking northwest at burial during
excavation - Room #1, 5DL975



Looking down on ash lens/ash pit
at tip of arrow - Room #1, 5DL975

Looking west at ash pit and west
wall floor of Room #1, 5DL975

Looking northeast at Room #1, 5DL975
after excavation

Looking northeast at Room #1, 5DL975
after backfilling

DESCRIPTION OF MEASUREMENTS

Metric Traits

Cranium

Note: except where noted, all of the following cranial measurements are described in Howells, 1973.

Alveolar Length, External: the distance along the midplane from prosthion to alveolon. Alveolon is defined as the intersection of the midplane and a line conneecting the posterior alveolar borders. Taken with the skull base up and a small stick resting behind the 3rd molars to define alveolon (Key, 1983).

Alveolus radius (at M1): the perpendicular to the transmeatal axis from the most anterior point on the alveolus of the left first molar.

Basion angle (nasion-bregma): the angle at basion whose sides are basion-nasion and basion-bregma (the opposite side being nasion-bregma chord).

Basion angle (nasion-prosthion): of the facial triangle, the angle at basion, whose sides are basion-nasion and basion prosthion.

Basion-bregma height: distance from bregma to basion.

Basion-prosthion length: the facial length from prosthion to basion.

Basion-nasion length: direct length between nasion and basion.

Basion Radius: the perpendicular to the transmeatal axis from basion (Key, 1983).

Biasterionic breadth: direct measurement from one asterion to the other.

Biauricular breadth: the least exterior breadth across the roots of the zygomatic processes, wherever found.

Bifrontal breadth: the breadth across the frontal bone between frontomalare anterior on each side, i.e., the most anterior point on the fronto-malar suture.

Bijugal breadth: the external breadth across the malars at the jugalia, i.e., at the deepest points in the curvature between the frontal and temporal process of the malars.

Bimaxillary breadth: the breadth across the maxillae, from one zygomaxillare anterior to the other.

Biorbital breadth: the breadth across the orbits from ectoconchion to ectoconchion.

Bistephanic Angle: the angle formed on the midplane of the frontal, whose sides reach from this point to stephanion, left and right. Calculated from bistephanic breadth and stephanic subtense (Key 1983).

Bistephanic breadth: breadth between the intersections, on either side, of the coronal suture and the inferior temporal line marking the origin of the temporal muscle (the stephanion points).

Bizygomatic breadth: the maximum breadth across the zygomatic arches, wherever found, perpendicular to the median plane.

Bregma-lambda chord (parietal chord): the external chord, or direct distance from bregma to lambda, taken in the midplane and at the external surface.

Bregma-lambda subtense (parietal subtense): the maximum subtense, at the highest point on the convexity of the parietal bones in the midplane, to the bregma-lambda chord.

Bregma Radius: the perpendicular to the transmeatal axis from bregma (Key, 1983).

Bregma-subtense fraction: the distance along the bregma-lambda chord, recorded from bregma, at which the bregma-lambda, or parietal, subtense falls.

Cheek height: the minimum distance, in any direction, from the lower border of the orbit to the lower margin of the maxilla, mesial to the masseter attachment, on the left side.

Cranial base angle: the angle at basion formed by the radius from basion to the transmeatal axis where the transmeatal axis is set equal to the biauricular breadth. Calculated from biauricular breadth and basion radius (Key, 1983).

Cranial breadth, maximum: the maximum cranial breadth perpendicular to the median sagittal plane (above the supramastoid crests).

Cranial breadth, minimum: the breadth across the sphenoid at the base of the temporal fossa, at the infratemporal crests.

Dacryal angle: the angle formed at dacryon by the orbital breadth from ectoconchion and the subtense from dacryon to biorbital breadth; right and left angles added.

Dacryon radius: the perpendicular to the transmeatal axis from the left dacryon.

Dacryon subtense: the mean subtense from dacryon (average of two sides) to the biorbital breadth.

Ectoconchion radius: the perpendicular to the transmeatal axis from the left ectoconchion.

Foramen magnum length: the length from basion to opisthion.

Frontal angle: in the sagittal plane, the angle underlying the curvature of the frontal bone at its maximum height above the frontal chord.

Frontal breadth, maximum: the maximum breadth at the coronal suture, perpendicular to the median plane.

Frontal breadth, minimum: the minimum breadth across the frontal, perpendicular to the median sagittal plane. Apply the caliper to the points of maximum incurvature of the temporal line. Taken with the skull on its base, with the face toward the observor (Key, 1983).

Frontomalare radius: the perpendicular to the transmeatal axis from the left frontomalare anterior.

Glabello-occipital length: greatest length, from the glabellar region, in the median sagittal plane.

Glabella projection: the maximum projection of the midline profile between nasion and supraglabellare (or the point at which the convex profile of the frontal bone changes to join the prominence of the glabellar region), measured as a subtense.

Interorbital breadth: the breadth across the nasal space from dacryon to dacryon.

Lambda-opisthion chord (occipital chord): the external occipital chord, or direct distance from lambda to opisthion taken in the midplane and at the external surface.

Lambda-opisthion subtense (occipital subtense): the maximum subtense, at the most prominent point on the basic contour of the occipital bone in the midplane.

Lambda Radius: the perpendicular to the transmeatal axis from lambda (Key 1983).

Lambda-subtense fraction: the distance along the lambda-opisthion chord, recorded from lambda, at which the lambda-opisthion, or occipital, subtense falls.

Malar length, inferior: the direct distance from zygomaxillare anterior to the lowest point of the zygo-temporal suture on the external surface, on the left side.

Malar length, maximum: total direct length of the malar in a diagonal direction, from the lower end of the zygo-temporal suture on the lateral face of the bone, to zygoorbitale, the junction of the zygo-maxillary suture with the lower border of the orbit, on the left side.

Malar subtense: the maximum subtense from the convexity of the malar angle to the maximum length of the bone, at the level of the zygomaticofacial foramen, on the left side.

Mastoid height: the length of the mastoid process below, and perpendicular to, the eye-ear plane, in the vertical plane.

Mastoid width: width of the mastoid process at its base, through its transverse axis.

Nasal breadth: the distance between the anterior edges of the nasal aperture at its widest extent.

Nasal height: the average height from nasion to the lowest point on the border of the nasal aperture on either side.

Nasio-frontal angle: the angle at nasion whose two sides reach from this point to frontomalare, left and right.

Nasio-frontal subtense: the subtense from nasion to the bifrontal breadth.

Nasion angle (basion-bregma): the angle at nasion whose sides are basion-nasion and nasion-bregma (the opposite side being basion-bregma).

Nasion angle (basion-prosthion): of the facial triangle, the angle at nasion, whose sides are basion-nasion and nasion-prosthion.

Nasion-bregma chord (frontal chord): the frontal chord, or direct distance from nasion to bregma, taken in the midplane and at the external surface.

Nasion-bregma subtense (frontal subtense): the maximum subtense, at the highest point on the convexity of the frontal bone in the midplane, to the nasion-bregma chord.

Nasion-prosthion height: upper facial height from nasion to prosthion.

Nasion radius: the perpendicular to the transmeatal axis from nasion.

Nasion-subtense fraction: the distance along the nasion-bregma chord, recorded from nasion, at which the nasion-bregma, or frontal, subtense falls.

Nasio-occipital length: greatest cranial length in the median sagittal plane, measured from nasion.

Naso-dacryal angle: the angle formed at the midline of the nasal bones, whose sides reach from this point to dacryon, left and right.

Naso-dacryal subtense: the subtense from the deepest point in the profile of the nasal bones to the interorbital breadth.

Occipital angle: in the sagittal plane, the angle underlying the curvature of the occipital bone at its maximum height above the occpital chord.

Opisthion radius: the perpendicular to the transmeatal axis from opisthion (Key 1983).

Orbit breadth, left: breadth from ectoconchion to dacryon, as defined, approximating the longitudinal axis which bisects the orbit into equal upper and lower parts.

Orbit height, left: the height between the upper and lower borders of the left orbit, perpendicular to the long axis of the orbit and bisecting it.

Palate breadth, external: the greatest breadth across the alveolar borders, wherever found, perpendicular to the median plane.

Parietal angle: in the sagittal plane, the angle underlying the curvature of the parietal bones along the sagittal suture, at its maximum height above the parietal chord.

Prosthion angle (basion-nasion): of the facial triangle, the angle at prostion, whose sides are basion-prosthion and nasion-prosthion.

Prosthion radius: the perpendicular to the transmeatal axis from prosthion.

Simotic angle: the angle at the midline of the nasal bones, at their narrowest point, whose sides reach to the end points of the minimum breadth of the nasal bones.

Simotic chord (Least nasal breadth): the minimum transverse breadth across the two nasal bones, or chord between the naso-maxillary sutures at their closest approach.

Simotic subtense: the subtense from the nasal bridge to the simotic chord, i.e., from the highest point in the transverse section which is at the deepest point in the nasal profile.

Stephanic subtense: the subtense from the surface of the frontal in the sagittal plane to the bistephanic breadth (as defined by Howells, and above). Taken with the skull on its base with the face toward the observor. Take bistephanic breadth with a coordinate caliper and drop the subtense along the midline so that it is perpendicular to the bone surface. Make no reference to the coronal plane (Key 1983).

Subspinale radius: the perpendicular to the transmeatal axis from subspinale.

Supraorbital projection: the maximum projection of the left supraorbital arch between the midline, in the region of glabella or above, and the frontal bone just anterior to the temporal line in its forward part, measured as a subtense to the line defined.

Vertex radius: the perpendicular to the transmeatal axis from the most distant point on the parietals (including bregma or lambda), wherever found.

Zygomaxillare radius: the perpendicular to the transmeatal axis from the left zygomaxillare anterior.

Zygomaxillary angle: the angle at subspinale whose two sides reach from this point to zygomaxillare anterior left and right.

Zygomaxillary subtense /Bimaxillary subtense: the projection or subtense from subspinale to the bimaxillary breadth.

Zygoorbitale radius: the perpendicular to the transmeatal axis from the left zygoorbitale.

Mandible

The following were gathered from a list of measurements in "A Computerized Skeletal Data Bank for Forensic Anthropology" by Peer H. Moore-Jansen and Richard L. Jantz, Department of Anthropology, University of Tennessee, Knoxville, 1986.

Height of Mandibular Body: (Martin 1956, Olivier 1969) from the alveolar process to and perpendicular to the inferior mandibular border at the level of the mental foramen.

Minimum Ramus Breadth: (Martin 1956, Montagu 1960, Olivier 1969) least breadth of mandibular ramus perpendicular to the height of the ramus.

Maximum Ramus Height: (Martin 1956) distance from highest point on mandibular condyle to Gonion.

Breadth of Mandibular Body: (Martin 1956, Olivier 1969) maximum breadth perpendicular to the long axis of the mandibular body at the level of the mental foramen.

Bigonial Width: (Bass 1971, Martin 1956, Montagu 1960, Olivier 1969) distance from gonion to gonion.

Bicondylar Breadth: (Bass 1971, Martin 1956, Olivier 1969) distance between lateral points of two condyles.

Chin Height: (Bass 1971, Hrdlicka 1952, Martin 1956, Montagu 1960, Olivier 1969) distance from infradentale to gnathion.

Dental Measurements

Mesio-distal diameter: (Bass 1971) maximum diameter between mesial and distal contact points.

Bucco-lingual diameter: (Bass 1971) maximum diameter at right angle to mesio-distal diameter.

Crown Index: $\frac{\text{Bucco-lingual diameter}}{\text{Mesio-distal diameter}} \times 100$

Postcranial

The following were gathered from a list of measurements taken for "Osteological Analysis of the William H. Over Collection: A Multifaceted Approach", by Douglas W. Owsley, Margaret J. Schoeninger, Kim N. Schneider, Donald J. Blakeslee, in preparation.

HUMERUS:

Maximum length: (Bass, 1971) Place the head against the fixed vertical of the board and adjust the movable upright to the distal end. Raise the bone slightly and move it up and down as well as from side to side until the maximum length is obtained.

Breadth of the upper epiphysis: (McHenry and Corruccini, 1978) Widest distance across the upper epiphysis; being sure to include the greater tubercle.

Maximum diameter of midshaft: (Bass, 1971) Taken at exactly mid-length. Maximum diameter in an anterior-medial direction.

Minimum diameter of the midshaft: (Bass, 1971) Diameter taken at right angle to maximum diameter at midshaft.

Maximum Diameter of Shaft: (France, 1983) Diameter taken at exact position of minimum, regardless of position relative to midshaft.

Minimum Diameter of Shaft: (France, 1983) Diameter taken at minimum measurement, regardless of position relative to midshaft.

Maximum Diameter of head: (Bass, 1971) Taken from a point on the edge of the articular surface of the bone across to the opposite side. The bone is rotated until the maximum distance is obtained.

Transverse Diameter of Head: (Dwight 1905; Martin 1928) measured where perpendicular to the shaft of the humerus, on the articular surface

Vertical Diameter of Head: (Dwight 1905); measured where parallel to the long axis of the shaft, on the articular surface

Biepicondylar breadth: (McHenry and Corruccini 1978) Maximum distance across the epicondyles on the distal end.

Width of Distal Articular Surface: (McHenry and Corruccini 1975; Martin 1928) measured across the anterior aspect of the articular surface from the lateral border of the capitulum to the medial border of the trochlea.

Least Circumference of Shaft: (Bass 1971) taken at about the second third of the shaft, distal to the deltoid tuberosity.

Circumference at Midshaft: taken with a cloth measuring tape at midshaft.

Supra-Condyloid Fossa: (Bass 1971) not a measurement, but a notation of presence of fossa just above distal articular surface.

RADIUS:

Maximum length: (Bass, 1971) Maximum length from head to tip of the styloid process. Head is placed against the fixed vertical section of the osteometric board and the movable portion is adjusted to the distal end. Bone is raised slightly and moved up and down and from side to side until maximum length is obtained.

Maximum diameter of the head: (Trotter and Gleser, 1952) Taken from a point on the edge of the articular surface of the bone across to the opposite side. The bone is rotated until the maximum distance is obtained.

Maximum circumference of the shaft: (Owsley et al, 1985) Taken at a point just superior to the radial tuberosity.

Distal Medio-Lateral Diameter: maximum measurement, however it is obtained

Circumference at Midshaft: taken with cloth measuring tape at midshaft.

ULNA:

Maximum length: (Bass, 1971) Maximum length from the top of the olecranon process to the tip of the styloid process.

Maximum breadth of the olecranon process: (McHenry and Corruccini 1978) Measured from the medial and lateral margins of the olecranon process´ articular surface at its greatest breadth.

Minimum breadth of the olecranon process: (McHenry and Corruccini, 1978) Measured from the medial and lateral margins of the olecranon process´ articular surface where the constriction on the medial margin becomes apparent.

Maximum width of the olecranon process: (McHenry and Corruccini, 1978) Measured in an antero-posterior direction from the anterior-most portion of the olecranon process to the posterior-most portion.

Olecranon process to radial notch length: (Owsley et al, 1985) From the most anteriorly-projecting point on the olecranon process to the inferior-most margin of the radial notch.

Olecranon process to coronoid process length: (McHenry and Corruccini, 1978) From the most anteriorly-projecting point on the olecranon process to the radial-most margin of the coronoid process.

Physiological length: (Bass, 1971) The two measuring points being the deepest point in the longitudinal ridge running across the floor of the semilunar notch and the deepest point of the distal surface of the head, not taking the groove between it and the styloid process.

Least circumference of the shaft: (Bass, 1971) Located a little above the distal epiphysis, where the shaft, through the reduction of the muscular ridges and crests, becomes nearly cylindrical.

Circumference at midshaft: taken with cloth measuring tape at midshaft.

FEMUR:

Maximum length: (Bass, 1971) Place the distal condyles against the fixed vertical of the board and the movable upright to the head. Raise the bone slightly and move up and down as well as from side to side until maximum length is obtained.

Oblique length: (Martin and Saller, 1957) Place both condyles in contact with the vertical foot board, reading of plane parallel to foot board and tangent to head.

Trochanteric length: (Martin and Saller, 1957) Greatest distance between top of greater trochanter and external condyle.

Subtrochanteric anterior-posterior diameter: (Bass, 1971) Taken on the shaft just below the lesser trochanter, with the gluteal tuberosity avoided.

Subtrochanteric medial-lateral diameter: (Bass, 1971) Taken at the same level as subtrochanteric anterior-posterior diameter above and perpendicular to it.

Anterior-posterior diameter of midshaft: (Bass, 1971) Locate midshaft point on osteometric board and mark bone with pencil. Measure anterior-posterior diameter.

Medio-lateral diameter of the midshaft: (Bass, 1971) Taken at right angle to anterior-posterior diameter of the midshaft.

Circumference of Midshaft: taken with cloth measuring tape at midshaft.

Vertical head diameter: (Martin and Saller, 1957) The greatest vertical diameter in the vertical plane passing through the axis of the neck.

Horizontal diameter of the Head: (Martin and Saller, 1957) The maximum diameter at right angle to the vertical head diameter.

Maximum Diameter of Head: taken from a point on the edge of the articular surface of the bone across to the opposite side. The bone is rotated until the maximum distance is obtained.

Anterior-posterior diameter of the lateral condyle: (Montagu, 1960) The projected distance between the most posterior point on the lateral condyle and lip of the patellar surface taken perpendicular to the axis of the shaft.

Anterior-Posterior Diameter of Medial Condyle: (Montagu 1960) the projected distance between the most posterior point on the medial condyle and the lip of the patellar surface taken perpendicular to the axis of the shaft.

Epicondylar breadth: (Martin and Saller, 1957) Measured over the most outstanding points of the epicondyles, parallel to the infracondylar plane.

Bicondylar breadth: (Hrdlicka, 1939) Greatest breadth across the condyles (transverse condylar breadth) taken at a point in the middle of each condyle (posteriorly).

Minimum vertical diameter of the neck: (Owsley, et al, 1985) The minimum vertical diameter of the neck (taken in conjunction with femoral neck angle). In this study, is measured from the sharp-shadow tracings.

Capito-collar length: (Owsley et al, 1985) The length of the head and neck from the center of the head, as projected onto the articular surface, to the coaxial point (measured directly from the drawing produced by the measurement of the femoral neck angle).

Neck angle: (Owsley et al, 1985) With the anterior aspect down, on an underlying sheet of paper, place the distal condyles against the fixed vertical of the board. Just below midshaft measure the medial-lateral diameter of the shaft, being sure to mark the endpoints of the diameter on the paper with the tips of the sliding calipers. Repeat this procedure just above midhsaft. Next, without moving the bone, measure the minimum vertical

diameter of the neck, again marking the endpoints on the paper. Then, place a straight edge flush with the tip of the articular surface of the head and approximately perpendicular to the long axis of the neck. Remove the bone while keeping the straight edge in place. Draw a line along the straight edge. Mark all points made with the calipers with a pencil. For each set of points determine the midpoint of the diameter (points A,B, and C). For the two sets of points along the shaft draw a straight line through the midpoints (A and B), extending the length of the paper. This line represents the long axis of the shaft. For the neck diameter, place a protractor along the diameter and centered at point C. Draw a line that is perpendicular to the diameter and extends through the line of the long axis of the shaft and through the articular surface line. This line represents the long axis of the neck. Where it intersects the long axis of the shaft is the coaxial point (D), where it intersects the articular surface line is the center of the head as projected to the articular surface (point E). The angle can then be measured at point D with a protractor. In this study the measurement is taken from the sharp-shadow tracings.

Femoral condyle angle: (Owsley et al, 1985) This angle can be easily obtained with the schematic diagram produced in measrurement above. The angle is measured at point F, where the long axis of the shaft intersects the line formed by the edge of the paper that is flush with the fixed vertical end of the board. This edge represents the transverse plane of the condyles. In this study the measurement is taken from the sharp-shadow tracings.

TIBIA:

Maximum length: (Wilder, 1920) End of malleolus against vertical wall of the osteometric board, bone resting on its dorsal surface with its long axis parallel with the long axis of the board, block applied to the most prominent part of the lateral half of the lateral condyle.

Maximum breadth of the proximal epiphysis: (McHenry and Corruccini, 1978) Maximum distance between the medial and lateral condyles.

Maximum breadth of the distal epiphysis: (McHenry and Corruccini, 1978) Maximum distance between the fibular articular surface and the medial surface of the medial malleolus.

Anterior-posterior diameter at the nutrient foramen: (Bass, 1971) Maximum anterior-posterior diameter of shaft at the nutrient foramen.

Medio-lateral diameter at the nutrient foramen: (Bass, 1971) Maximum transverse diameter at right angle to the anterior-posterior diameter at the nutrient forament.

Position of the nutrient foramen: (Owsley et al 1985) Measured from the top of the lateral intercondyloid eminence to the most distal point of the foramen.

Maximum diameter at midshaft: taken at exact middle of shaft, but not including the intercondyloid eminence

Circumference at Midshaft: taken with cloth tape at midshaft.

FIBULA:

Maximum length: (Bass, 1971) Maximum distance between the proximal and distal extremities.

Maximum diameter at midshaft: taken at exact middle of shaft.

Circumference at midshaft: taken with cloth measuring tape at midshaft.

CLAVICLE:

Maximum length: (Bass, 1971) Maximum distance between the lateral and medial extremities. The bone is moved from side to side and up and down until the maximum length is obtained.

Sagittal Diameter at midshaft: (Martin 1957) distance from the anterior to the posterior surface of the midshaft.

Vertical Diameter at midshaft: (Martin 1957) distance from the cranial to the caudal surface of the midshaft.

Circumference at midshaft: taken with cloth measuring tape at midshaft.

SCAPULA:

Maximum length: (Bass, 1971) The maximum straight line distance from the superior to the inferior border.

Maximum breadth: (Bass, 1971) From the middle of the dorsal border of the glenoid fossa to the spinal axis on the vertebral border.

Scapula Index: $\frac{\text{Maximum Breadth}}{\text{Maximum Length}}$

Length of spine: (Bass, 1971) From the end of the spinous axis on the vertebral border to the most lateral point of the acromion process.

Length of the supra-spinous line: (Bass, 1971) From the end of the spinous axis on the vertebral border to the top of the anterior angle.

Length of infra-spinous line: (Bass, 1971) From the end of the spinous axis on the vertebral border to the tip of the inferior angle.

Glenoid cavity breadth: (McHenry and Corruccini, 1978) Taken at a point just below the constriction of the ventral border. Measured across the breadth of the glenoid cavity from the ventral to the dorsal margin.

Glenoid cavity height: (McHenry and Corruccini, 1978) Taken from the superior to he inferior margin of the glenoid cavity, being sure that the measurement is taken perpendicular to the glenoid cavity breadth.

Mid-glenoid to inferior angle length: (Ingalls, 1924) Taken from the middle of the glenoid cavity to the inferior angle.

Lateral border angle: (Owsley et al, 1985) Of the inferior scapular body, the angle at the dorsal margin of the glenoid cavity, whose sides are maximum breadth and mid-glenoid to inferior angle length. Computed from the three sides of the triangle, maximum breadth, mid-glenoid to inferior angle length, and infraspinous line length.

Vertebral border angle: (Owsley et al, 1985) Of the inferior scapular body, the angle at the point of the spinous axis on the vertebral border, whose sides are maximum breadth and infraspinous line length. Computed from the three sides of the triangle, maximum breadth, infraspinous line length and mid-glenoid to inferior angle length.

Inferior angle: (Owsley et al, 1985) Of the inferior scapular body, the angle at the inferior border, whose sides are mid-glenoid to inferior angle and infraspinous line length. Computed from maximum breadth, mid-glenoid to inferior angle length and infraspinous line length.

Superior angle: (Owsley et al, 1985) Of the medial scapula body, the angle at the superior border, whose sides are supraspinous line length and maximum length. Computed from maximum length, supraspinous line length and infraspinous line length.

Caudal angle: (Owsley et al, 1985) Of the medial scapular body, the angle at the inferior border, whose sides are maximum length and infraspinous line length. Computed from maximum length, supraspinous line length and infraspinous line length.

Medial angle: (Owsley et al, 1985) Of the medial scapular body, the angle at the point of the spinous axis on the vertebral border, whose sides are supraspinous line length and infraspinous line length. Computed from maximum length, supraspinous line length and infraspinous line length.

INNOMINATA:

Maximum Height: (Bass 1971) maximum distance measured from the caudal point on the ischium to the most cephalic point on the iliac crest.

Maximum Width: (Bass 1971) widest distance across the iliac blade.

Maximum ischio-pubic diameter: (Comas 1960) measured from the corner of the pubic symphysis to the most distant point on the ischial tuberosity.

Minimum ilium width: (Comas 1960) shortest distance from the sacro-iliac notch to the point where the ilium forms the beginning of the pubic ramus. The specimen is positioned such that the measurer is looking directly into the acetabulum at eye level.

Height of the pubic symphysis: (Steudel 1981) from the most superior to the inferior points comprising the bony symphysis between the two pubic bones.

Pubic symphysis to anterior superior spine: (Owsley, Schoeninger, Schneider, and Blakeslee, in preparation) from the upper border of the symphyseal face to the anterior superior spine at its most anterior projection.

Pubic symphysis to anterior inferior spine: (Owsley, et al. in preparation) from the upper border of the symphyseal face to the anterior inferior spine at the midpoint of its most anterior projection.

Pubic symphysis to auricular surface: (Owsley et al., in preparation) from the upper border of the symphyseal face to the pectineal line where it meets the auricular surface.

Pubic symphysis to mid-sciatic notch: (Owsley et al., in preparation) from the upper border of the symphyseal face to the midpoint of the greater sciatic notch.

Pubic symphysis to terminal tip of the auricular facet: (Steudel 1981) from the upper border of the symphyseal face to the terminal tip of the auricular surface.

Pubic symphysis to posterior superior spine: (Owsley et al., in preparation) from the upper border of the symphyseal face to the posterior superior spine at the most posterior projection.

Pubic symphysis to nearest acetabular border: (Day and Pitcher-Wilmont 1975) from the upper border of the symphyseal face to the nearest acetabular border.

Pubic symphysis to inferior ischial tuberosity: (Owsley et al., in preparation) from the upper border of the symphyseal face to the most inferior portion of the ischial tuberosity.

Pubic Length: (Washburn 1948) from the point at which the ischium and pubic meet in the acetabulum to the furthest extension of the symphysis.

Ischial Length: (Washburn 1948) from the point at which the ischium and pubis meet in the acetabulum to the most inferior extension of the ischial tuberosity.

Acetabulum to posterior superior spine: (Owsley et al., in preparation) from the point at which the ischium and pubis meet in the acetabulum to the posterior superior spine.

Acetabulum to posterior inferior spine: (Owsley et al., in preparation) from the point at which ischium and pubis meet in the acetabulum to the terminal tip of the auricular facet.

Acetabulum to anterior superior spine: (Owsley et al., in preparation) from the point at which the ischium and pubis meet in the acetabulum to the anterior superior spine.

Acetabulum to anterior inferior spine: (Owsley et al., in preparation) from the point at which the ischium and pubis meet in the acetabulum to the anterior inferior spine.

Maximum diameter of the acetabulum: (Day and Pitcher-Wilmott 1975) maximum diameter of the acetabulum measured from inner border to inner border.

Maximum length of the auricular surface: (Comas 1960) greatest length across the auricular surface.

Auricular surface to mid-sciatic notch: (Owsley et al., in preparation) measured from the point where the pectineal line meets the auricular surface to the midpoint of the greater sciatic notch.

Auricular surface to acetabular border: (Owsley et al., in preparation) measured from the point where the pectineal line meets the auricular surface to the nearest acetabular border.

Auricular surface to anterior superior spine: (Owsley et al., in preparation) measured from the point where the pectineal line meets the auricular surface to the anterior superior spine.

Auricular surface to anterior inferior spine: (Owsley et al., in preparation) measured from the point where the pectineal line meets the auricular surface to the anterior inferior spine.

Auricular surface to posterior superior spine: (Owsley et al., in preparation) measured from the point where the pectineal line meets the auricular surface to the posterior superior spine.

Auricular surface to terminal tip of the auricular surface: (Owsley et al., in preparation) measured from the point where the pectineal line meets the auricular surface to the terminal tip of the auricular surface.

Inferior iliac breadth: (Steudel 1981) taken from the terminal end of auricular surface to a point on the most anterior margin of the anterior inferior spine.

Superior iliac breadth: (Steudel 1981) measured from anterior superior spine to posterior superior spine.

Middle width of the pubis: (Day and Pitcher-Wilmott 1975) from a point halfway down to the pubic ramus to the nearest point on the obturator foramen, parallel to the superior ramus.

Height of the obturator foramen: (Day and Pitcher-Wilmott 1975) maximum vertical measurement of the obturator foramen perpendicular to the superior pubic ramus.

Width of the obturator foramen: (Day and Pitcher-Wilmott 1975) maximum horizontal diameter of the obturator foramen parallel to the superior pubic ramus.

Length of the ischial tuberosity: (Steudel 1981) taken from the most superior extent of the tuberosity at its most medial extent in a straight line.

Breadth of the ischial tuberosity: (Steudel 1981) maximum breadth across the ischial tuberosity.

Sciatic notch subtense: (Owsley et al., in preparation) maximum depth of the sciatic notch perpendicular to the above.

Sciatic notch fraction: (Owsley et al., in preparation) point of maximum depth on the sciatic notch chord.

Anterior border breadth (anterior border chord): (Owsley et al., in preparation) measured from anterior superior spine to anterior inferior spine.

Anterior border subtense: (Owsley et al., in preparation) maximum depth of the anterior border perpendicular to the above.

Anterior border fraction: (Owsley et al., in preparation) point of maximum depth on the anterior border chord.

SACRUM:

Mid-ventral straight length: (Fawcett 1938) maximum distance measured from the midpoint of the sacral promontory to the most distant point on the last sacral vertebra (sacral chord).

Sacral subtense: (Owsley et al., in preparation) maximum depth of curvature measured perpendicular to the mid-ventral straight line.

Sacral fraction: (Owsley et al., in preparation) point of maximum curvature measured on the sacral chord from proximal border.

Anterior straight breadth: (Fawcett 1938) maximum breadth taken as the maximum transverse distance across the sacral alae.

Transverse diameter of the first sacral vertebra: (Flanders 1978) maximum transverse distance across the centrum of the first sacral vertebra.

Anteroposterior diameter of the first sacral vertebra: (Flanders 1978) maximum anteroposterior diameter of the first sacral vertebra.

Basal width: (Fawcett 1938) maximum transverse distance across the last sacral vertebra at the coccygeal articulation.

NON-METRIC CRANIAL TRAITS

PLEASE NOTE: the following descriptions are not meant to be exhaustive! Please go to the sources listed for more complete definitions of the features noted.

Accessory infraorbital foramen: one or two accessory foramina adjacent to the infraorbital foramen (Birkby 1973, Finnegan 1972, Jantz 1970, Suchey 1975).

Accessory lesser palatine foramen: one or more foramina for the lesser palatine nerves lying posteriorly to the greater palatine foramen (Birkby 1973, Finnegan 1972, Jantz 1970, Suchey 1975).

Accessory mandibular foramen: small inconstant foramen usually situated posteriorly to the mandibular foramen coursing in the same direction as the latter (Birkby 1973).

Accessory zygo-facial foramen: accessory foramina present on the malar (zygomatic) bone (Birkby 1973).

Anterior condylar canal double: canal which transmits the hypoglossal nerve divided into two parts (Finnegan 1972, Jantz 1970, Suchey 1975), also called Hypoglossal Canal Double (Birkby 1973).

Anterior ethmoid foramen (extra-sutural): foramen ordinarily piercing the middle portion of the fronto-ethmoidal suture, but occasionally lying above the suture and perforating only the frontal bone (Birkby 1973, Finnegan 1972).

Asterionic Ossicle: a separate bone at the junction of the lambdoid, mastoid, and parieto-mastoid sutures (Birkby 1973, Finnegan 1972, Jantz 1970, Suchey 1975).

Auditory torus, also ear exostosis: a bony ridge on the floor of the external auditory meatus (Birkby 1973, Finnegan 1972, Hrdlicka 1935, Suchey 1975)

Bregmatic bone: a separate bone located at the junction of the sagittal and coronal sutures (Birkby 1973, Finnegan 1972, Jantz 1970, Suchey 1975).

Canaliculus innominatus: tiny canal or foramen perforating the sphenopetrosal lamina behind and medial to foramen ovale (Birkby 1973).

Caroticoclinoid foramen: foramen formed by the ossified caroticoclinoid ligament bridging the anterior and middle clinoid processes of the sphenoid (Birkby 1973).

Clino-clinoid bridge: bony bridging of the sella turcica which incorporates the anterior and posterior clinoid processes (Birkby 1973).

Condylar facet double: the occipital condyle divided into two distinct condyles (Birkby 1973, Finnegan 1972, Suchey 1975).

Coronal ossicle: one or more separate bones located in the coronal suture (Finnegan 1972, Jantz 1970, Suchey 1975), but outside the area of the bregmatic ossicle (Birkby 1973).

Diagastric groove double: disagastric groove appears to be bipartite (Finnegan 1972).

Double mental foramen: one or more foramina associated with the mental foramen (Birkby 1973), also called accessory mental foramen (Finnegan, 1972).

Epiteric bone: a separate bone located in the pterion region (Finnegan 1972, Jantz 1970, Suchey 1975), also known as the pterion ossicle (Berry and Berry 1967), found between the greater wing of the sphenoid and the sphenoid border of the parietal (Birkby 1973).

External frontal sulcus: vascular depressions occurring on the external surface of the frontal bone usually between the frontal eminence and the fronto-temporal crest (Birkby 1973).

Foramen of Huschke: a foramen on the floor of the external auditory meatus (Birkby 1973, Finnegan 1972, Jantz 1970, Suchey 1975).

Foramen ovale incomplete: posterior medial wall of foramen incompletely formed or missing (Birkby 1973).

Foramen ovale open: foramen ovale continuous with the foramen spinosum when postero-lateral wall of the foramen ovale is deficient (Finnegan 1972, Suchey 1975).

Foramen spinosum open: incomplete posterior wall of the foramen spinosum (Finnegan 1972, Suchey 1975), located on the inferior surface of the greater wing of the sphenoid posterior and lateral to the foramen ovale (Birkby 1973).

Foramen of Vesalius: medial to the foramen ovale, opposite the root of the pterygoid process, and opening near the scaphoid fossa (Finnegan 1972).

Frontal foramen: well-defined foramen lateral to supra-orbital foramen. Must not open into the orbital cavity, as does the supra-orbital foramen, but directly into the diploic space (Birkby 1973, Finnegan 1972, Jantz 1970, Suchey 1975).

Frontal notch: at supero-medial angle of orbital border medial to supra-orbital foramen or notch (Birkby 1973, Suchey 1975).

Fronto-temporal articulation: the frontal and temporal bones in direct contact in the pterion region (Birkby 1973, Jantz 1970, Suchey 1975). Also termed pterion form "X" where frontal and temporal bones are in direct contact at a point, and "K", again for the shape of the articulation (Finnegan 1972).

Highest nuchal line present: arises with the superior nuchal line at the external occipital protuberance, and arches anteriorly and laterally (Finnegan 1972).

Lacrimal foramen: found in the orbital plate of the sphenoid or frontal bone just beyond the supero-lateral end of the superior orbital fossa (Birkby 1973).

Lambdoid ossicle: ossicles occurring in the lambdoid suture (except those at lambda or in the asterion region) (Birkby 1973, Finnegan 1972, Jantz 1970, Suchey 1975).

Mandibular foramen double: at its opening (Finnegan 1972).

Mandibular torus: smoothly rounded exostosis located on the lingual surface at the border between the body of the mandible and the alveolar process (Birkby 1973, Finnegan 1972, Jantz 1970).

Mastoid foramen: foramen which transmits vein to the transverse sinus (Birkby 1973, Finnegan 1972, Jantz 1970, Suchey 1975)

Mastoid foramen exsutural: the mastoid foramen lying off the suture on either the temporal or occipital sides (Birkby 1973, Finnegan 1972, Jantz 1970, Suchey 1975).

Maxillary torus: a bony ridge extending along the lingual aspects of the roots of the molar teeth (Suchey 1975), also termed malar tubercle (Finnegan 1972).

Metopic suture: presence of patent medio-frontal suture. This suture sometimes does not disappear (as it normally does) in adulthood (Birkby 1973, Finnegan 1972, Jantz 1970, Suchey 1975).

Mylohyoid bridge: bridging of the mylohyoid groove of the mandible (Birkby 1973, Finnegan 1972, Jantz 1970).

Os Inca: extends inferiorly from lambda to the bi-asterionic line (Birkby 1973, Finnegan 1972, Jantz 1970).

Os Japonicum: bipartite malar/zygomatic bone, usually with the dividing suture coursing anteriorly-posteriorly from the maxillary border through the temporal process (Birkby 1973, Finnegan 1972).

Ossicle at Lambda: a separate bone located at the junction of the sagittal and lambdoid sutures (Birkby 1973, Finnegan 1972, Jantz 1970). Sutural bones of various sizes along with apical and Inca bones are included in this category (Suchey 1975).

Ossicle in the mastoid suture: a separate bone located inferior to the ossicle at asterion, between the temporal and occipital bones (Jantz 1970, Suchey 1975), also called Riolan´s ossicle (Birkby 1973).

Palatine torus: a bony ridge running along the hard palate (Finnegan 1972, Jantz 1970, Suchey 1975), for half or all of the bony palate (Birkby 1973).

Paramastoid process: (also called paraoccipital or paracondyloid process), located on inferior surface of the occipital between the foramen magnum and the mastoid process (Birkby 1973, Finnegan 1972).

Parietal foramen: small foramina occurring lateral to the sagittal suture anterior to lambda (Birkby 1973, Suchey 1975).

Parietal notch bone: a separate bone in the squamosal suture near the mastoid portion of the temporal bone (Birkby 1973, Finnegan 1972, Jantz 1970, Suchey 1975).

Petrosquamous suture: on the mastoid process between the supra-mastoid crest and the tip of the mastoid process itself (Birkby 1973).

Pharyngeal fossa: a depression occurring in the central part of the basilar portion of the occipital bone (Birkby 1973, Jantz 1970, Suchey 1975).

Posterior condylar canal: foramen located in the floor of the condyloid fossa immediately posterior to one of the occipital condyles (Birkby 1973, Finnegan 1972).

Posterior ethmoid foramen: situated above the fronto-ethmoidal suture near the confluence of that suture with the spheno-ethmoidal suture (Birkby 1973, Finnegan 1972).

Posterior malar foramen: occurring only on the temporal surface of the malar usually at the junction of the large ascending frontal process and the main body of the bone (Birkby 1973).

Precondylar tubercle: a bony tubercle located immediately anterior and medial to the occipital condyle (Birkby 1973, Finnegan 1972, Suchey 1975).

Pterygo-alar foramen of Hyrtl: formed by a bar of bone connecting the inferior lateral surface of the greater wing of the sphenoid to the root of the lateral pterygoid plate (Birkby 1973).

Sagittal ossicle: a separate bone located in the sagittal suture (Finnegan 1972, Jantz 1970, Suchey 1975).

Spine of Henle: small tubercle of bone projecting from the posterosuperior margin of the external auditory meatus. Also known as suprameatal spine (Birkby 1973).

Stylo-mastoid foramen: immediately posterior to the styloid process (Finnegan 1972).

Superior sagittal sinus turns left: exits through the left jugular foramen (Jantz 1970).

Supraorbital foramen: a complete foramen on the medial aspect of the upper orbit through which supraorbital vessels and nerves are transmitted (Birkby 1973, Finnegan 1972, Jantz 1970, Suchey 1975).

Supraorbital notch: an incomplete (open) supraorbital foramen (Birkby 1973, Finnegan 1972).

Supra-trochlear spur: thin bony spine or spur eminating from medial wall of orbital roof just behind supero-medial angle of the orbital margin (Birkby 1973).

Suture in the infraorbital foramen: a suture occurring in the primary or accessory infraorbital foramen (Birkby 1973, Jantz 1970, Suchey 1975).

Temporo-Squamous ossicles: thin bones found between squamous portion of the temporal bone and the parietal; must not be in contact with the greater wing of the sphenoid (Birkby 1973).

Zygomatico-facial foramen: one or more foramina present on the zygomatic bone (Finnegan 1972, Suchey 1975), also known as Zygo-facial foramen (Birkby 1973).

Zygo-maxillary tuberosity: roughened downward projection at the lower end of the junction between the zygoma and the maxilla (Finnegan 1972).

Zygo-root foramen: foramen on the superior medial surface of the junction of the temporal squamous and the zygomatic process (Birkby 1973).

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